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TWENTY-SEVENTH ANNUAL REPORT

OF THE

New York State College of Agriculture

AT

CORNELL UNIVERSITY

AND THE

Agricultural Experiment Station

Established under the Direction of Cornell University

ITHACA, N. Y.

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Cornell Rural School Leaflet

FOR BOYS AND GIRLS

Published by the Department of Rural Education, New York State College of Agriculture at Cornell University. W. A. Stocking, jr., Acting Director. Entered as second-class matter, Ithaca, New York

ALICE G. McCLOSKEY and EDWARD M. TUTTLE, Editors

ARTHUR D. DEAN, C. EDWARD JONES, G. F. WARREN, and C. H. TUCK, Advisers

Vol. 7 ITHACA, NEW YORK, NOVEMBER, 1913 No. 2

UNIVERSITY OF ILLINOIS LIBRARY URBANA

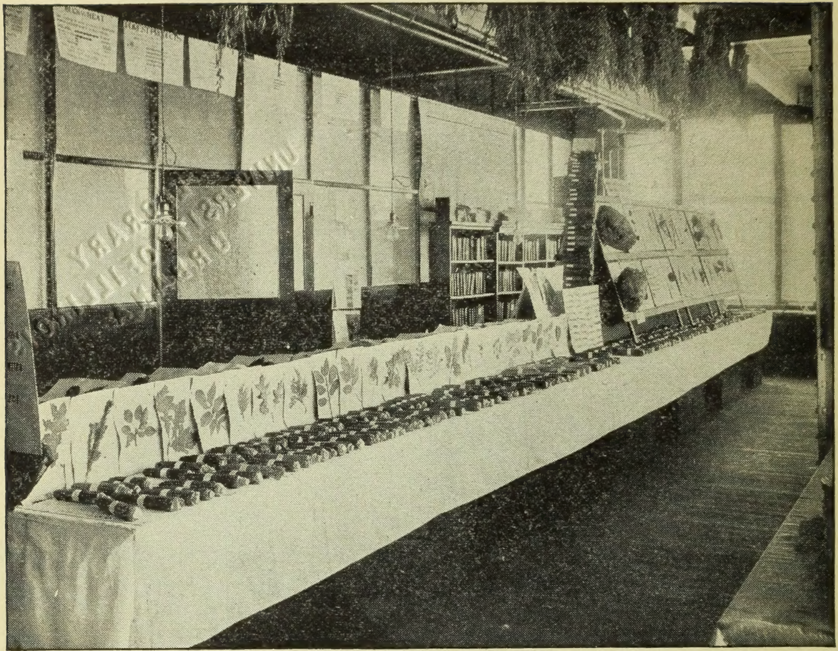
" I've plucked the berry from the bush, the brown
nut from the tree,
But heart of happy little bird ne'er broken was
by me.
I saw them in their curious nests, close crouching,
slyly peer
With their wild eyes, like glittering beads, to note
if harm were near;
I passed them by, and blessed them all; I felt that
it was good
To leave unmoved the creatures small whose home
was in the wood."

WILLIAM MOTHERWELL

323933

CORN DAY

(FRIDAY, DECEMBER 5, 1913)



Rural school exhibit at the New York State College of Agriculture, Farmers' Week, February, 1913

What is Corn Day? Many girls and boys in New York State could answer this question for they have had a part in Corn Day in years past. They would say that Corn Day is a day in the school year, coming at the end of the harvest season — the first Friday in December, to be exact — when special thought and study are given to corn.

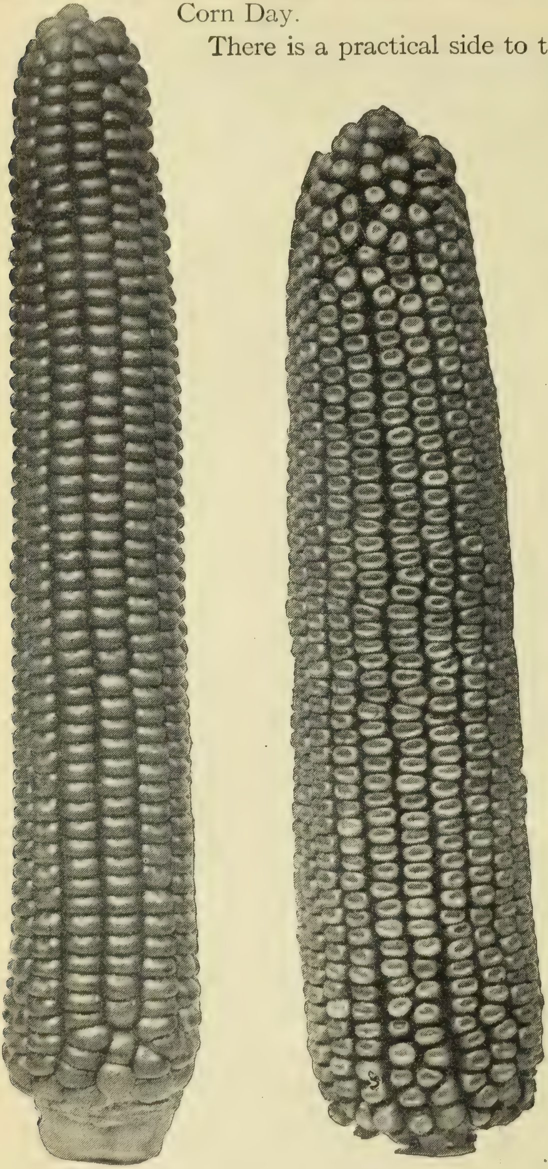
Why should corn be studied? The same children would answer that it should be studied because it is one of our most important crops, because it is found in every community, because its life history is intensely interesting, and because it responds to intelligent care in a wonderful way.

Corn Day has been observed in some schools for many years. Other schools have never celebrated it. We hope that this year may mark a great step forward, and that on December 5 every rural school in New York State will have some kind of exercise on corn. When Corn Day has become a real part of the school year other crops may be considered in like manner — potatoes, oats, beans, fruits, or vegetables. First, however, there must be definite results with one crop that will count in the State as a whole. With this in mind each school should decide to do its part this year. Very simple exercises may be held; if there is time and good spirit, the exercises may be more elaborate.

In the fall the corn is ripe, and ears can easily be obtained for an exhibit at the school. Care should be taken in selecting the ears. It is not enough to snatch them hastily from the crib. Thought should be given to find those that conform most closely to the ideal of perfection. (See September Rural School Leaflet for 1913, page 180.) The school exhibit should illustrate definite things. It should show not only good ears of corn, but also poor ears of corn, and boys and girls should know why some ears are good and why some are poor. The exhibit should display the various types of corn grown in the neighborhood. It should illustrate methods of storing seed corn. It should show a germination test. It should be artistically arranged. In addition to the corn itself, corn products may be displayed — products that are used as food for human beings and products that are used as food for animals. Records and reports of corn growing in the neighborhood will add to the interest. These records may be made from original investigations by the pupils. The test of any exhibit is the amount of explanation that it requires. A good exhibit speaks for itself and is so simple that it clearly demonstrates interesting points. A poor exhibit is confusing and some one is needed to tell what it means. It will take thought to make the school exhibit speak.

Rural school exhibit at the New York State College of Agriculture, Farmers' Week, February, 1913

It will also take originality; and some boy or girl will have the satisfaction of working out an idea that will appeal to all who come to the school on Corn Day.



Flint *Dent*

Prize ears of corn in the rural school exhibit, Farmers' Week, February, 1913

There is a practical side to the study of corn that will interest fathers and brothers. Remarkable results have been obtained in recent years by carefully selecting the seeds of various crops. Corn is one of the best for this purpose. If care is taken at harvest time to properly choose the best ears for seed the next year, if these ears are carefully stored during the winter, and if this operation is repeated for two or three years, the result will be evident. It will be seen that there is an improvement in the corn as a whole, that the ears are more uniformly good, and that the yield is higher. Boys and girls can help to bring this about.

Ask the teacher to read the article in the September leaflet on page 179. This will give some further suggestions about things to do on Corn Day; it will tell the points that one should consider in selecting corn for seed; it will suggest programs that are appropriate. Make plans ahead: plan the program; plan the exhibit; plan to decorate the schoolroom; plan to have some one who will judge the corn; plan to invite parents and friends. Have everything in readiness to make Corn Day a real event in the school.

Of course, the great value of Corn Day will be for the school that celebrates it; but we want others to know what schools hold Corn Day and so we are going to suggest that two ears of corn be sent to us to represent each school at Farmers' Week, which is to be held at the State College of Agriculture in February. Last year we tried having one ear of corn sent to us, and 441 schools responded. It was suggested by a trustee who was interested that we ought to have two ears from each school, one ear of flint corn and one ear of dent corn. The suggestion is good and we shall carry it out this year.

The two ears to be sent should be the very best from the school exhibit. They should be wrapped carefully and mailed by parcel post to Edward M. Tuttle, College of Agriculture, Ithaca, New York, as soon after Corn Day as convenient and not later than January 31. Each ear should be labeled and, in order that the labels may be uniform, we give the following suggestions: Make the label of plain white paper, one inch wide. It should be long enough to wrap around the middle of the ear of corn and be pasted at the back. On the front of the label print neatly the following:

....county
District number.............. Town of..............................
...., Teacher
......................., ..., New York
...., District Superintendent

In the pictures of last year's exhibit these labels can be seen. They are very neat, and if put on tightly remain in position. The ears can be handled without touching the labels and all the information can be easily seen. It will be a valuable exercise to make these labels and to see that they are right. We urge that care be taken to send the ears of corn to us in good condition and ready to be exhibited. They will be arranged by counties and supervisory districts and we want every school represented. Last year there was a great deal of interest shown by the visitors during Farmers' Week, and some were very much disappointed not to find corn from their home districts. We are sure there will be no disappointments this year.

The corn will be judged by experienced persons at the New York State College of Agriculture, and the best ears of flint and dent corn will be selected for each county. From these, the two best ears in the whole

State will be chosen. A ribbon will be sent to each school that has a prize ear for the county, and the two schools having the prize ears for the State will each be given a suitable reward. The prize ears for the county and for the State will be returned to the schools that send them, with instructions for planting, culture, and further selection, so that some of the pupils may carry on the improvement. The other ears will be given to the Farmers' Week visitors on the last day of the week. This will be a big event, for there will be good ears that do not win a prize and there will be persons who want them to take home and use for seed. Thus a school in one part of the State may help another part of the State to have better corn. There will be a neighborliness about this mutual help that will add spirit to the exhibit. We shall urge each person who takes an ear of corn to write to the school that it represents and let the boys and girls know where it is and what is being done with it. Thus year after year a school can keep track of corn that was sent to the college, and gradually the whole State will have better corn because the schools have celebrated Corn Day.

As we stated, we are printing the following complete list of the schools that sent corn to us last Farmers' Week:

County	Town	District	Teacher	District superintendent
Albany	Knox	3	Adelaide Dyer	W. J. Haverly
Albany	Knox	10	Irene L. Lee	W. J. Haverly
Albany	Rensselaerville	19	A. I. Kingsley	W. J. Haverly
Albany	Guilderland	3	Emma E. Hunnikin	W. S. Clark
Allegany	Rushford	12	Mrs. Maude H. Robbins	G. W. D'Autremont
Broome	Chenango	1	Mary C. Sullivan	E. B. Whitney
Broome	Chenango	3	Martha Glezen	E. B. Whitney
Broome	Chenango	4	Leola St. John	E. B. Whitney
Broome	Chenango	12	Edna G. Potter	E. B. Whitney
Broome	Nanticoke	4	Anna E. Driscoll	E. B. Whitney
Broome	Triangle	4	Rebecca L. Elliot	E. B. Whitney
Broome	Triangle	7	Ada L. Barrett	E. B. Whitney
Broome	Triangle	9	Kate R. Elliot	E. B. Whitney
Broome	Binghamton	2	Mary Kelly	Mabel L. Watrous
Broome	Binghamton	3	Viola Sibley	Mabel L. Watrous
Broome	Maine	3	Mrs. Della Brigham	Mabel L. Watrous
Broome	Maine	4	Lala Dence	Mabel L. Watrous
Broome	Maine	9	Mrs. Anna Brown	Mabel L. Watrous
Broome	Maine	10	Mabel Howard	Mabel L. Watrous
Broome	Maine	12	Emma Vandeburg	Mabel L. Watrous
Broome	Maine	14	Hazel L. Phipps	Mabel L. Watrous
Broome	Union	2	Josephine Deyo	Mabel L. Watrous
Broome	Union	3	Josephine Rathbun	Mabel L. Watrous
Broome	Union	15	Nina S. Rodman	Mabel L. Watrous
Broome	Union	18	L. DeLano	Mabel L. Watrous
Broome	Vestal	4	Pearl E. Tompkins	Mabel L. Watrous
Broome	Vestal	13	Helen E. Ball	Mabel L. Watrous
Broome	Vestal	..	William L. Cobb	Mabel L. Watrous
Cattaraugus	Machias	14	Eva A. Armstrong	J. J. Crandall
Cayuga	Conquest	1	Bertha Rumsey	H. S. R. Murphy
Cayuga	Conquest	10	Ruth E. Tyler	H. S. R. Murphy
Cayuga	Conquest	14	Caroline Smith	H. S. R. Murphy
Cayuga	Ira	3	Lucy A. Durkee	H. S. R. Murphy
Cayuga	Ira	10	Gertrude Lenton	H. S. R. Murphy
Cayuga	Ira	13	W. N. R. Ashmead	H. S. R. Murphy
Cayuga	Sterling	10	Raymond Cooper	H. S. R. Murphy
Cayuga	Sterling	11	Agnes L. Long	H. S. R. Murphy
Cayuga	Sterling	15	Mrs. Grace Carter	H. S. R. Murphy
Cayuga	Victory	8	Miriam A. Raasch	H. S. R. Murphy
Cayuga	Mentz	3	Celia J. Higby	O. W. Wood
Cayuga	Montezuma	7	Mrs. Antoinette Vincent	O. W. Wood
Cayuga	Springport	2*	Margaret Melvin	Mrs. A. M. Kent

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* Prize ear of dent corn.

County	Town	District	Teacher	District superintendent
Cayuga	Venice	12	Frances E. Mosher	G. B. Springer
Chautauqua	Busti	3	Mabel R. Shaw	J. M. Barker
Chautauqua	Clymer	7	Gertrude Ostrye	J. M. Barker
Chautauqua	Harmony	12	Beulah R. Wilcox	J. M. Barker
Chautauqua	Pomfret	16	Russell H. Droman	L. W. Swain
Chautauqua	Portland	11	Amy Skinner	L. W. Swain
Chautauqua	Charlotte	10	Inza B. Smith	J. S. Wright
Chautauqua	Ellicott	10	Althea V. Johnson	J. S. Wright
Chenango	German	6	Bertha M. Green	J. S. Childs
Chenango	German	8	Bessie F. Purdy	J. S. Childs
Chenango	McDonough	1	Ruth Purdy	J. S. Childs
Chenango	McDonough	6	Izora B. Thompson	J. S. Childs
Chenango	Oxford	4	Laura N. Haynes	J. S. Childs
Chenango	Oxford	5	Carrie A. Hoyt	J. S. Childs
Chenango	Oxford	7	Mrs. Dania Wilder	J. S. Childs
Chenango	Oxford	13	Helen L. Harper	J. S. Childs
Chenango	Oxford	15	L. Mabel Wales	J. S. Childs
Chenango	Oxford	17	Marion L. Day	J. S. Childs
Chenango	Preston	1	Bernice L. Bowers	J. S. Childs
Chenango	Preston	2	Mrs. Nora Dunckel	J. S. Childs
Chenango	Preston	3	Mildred F. Spaulding	J. S. Childs
Chenango	Preston	4	Margaret McMahon	J. S. Childs
Chenango	Preston	5	Minette E. Torrey	J. S. Childs
Chenango	Smithville	2	Orla Avery	J. S. Childs
Chenango	Smithville	7	Lena E. Merrell	J. S. Childs
Chenango	Smithville	8	Jessie B. Clark	J. S. Childs
Chenango	Smithville	11	S. Lucy Wade	J. S. Childs
Clinton	Ausable	3	Thomas I. Ryan	O. A. Wolcott
Clinton	Black Brook	4	Annie M. Facteau	O. A. Wolcott
Clinton	Black Brook	6	Mae E. Conway	O. A. Wolcott
Clinton	Peru	2	D. B. Arnold	O. A. Wolcott
Clinton	Peru	5	Unknown	O. A. Wolcott
Clinton	Peru	6	Unknown	O. A. Wolcott
Clinton	Plattsburg	11	Margaret K. Harney	O. A. Wolcott
Clinton	Plattsburg	12	Unknown	O. A. Wolcott
Clinton	Plattsburg	13	Nora Crowley	O. A. Wolcott
Clinton	Saranac	1	Gertrude V. Facteau	O. A. Wolcott
Clinton	Saranac	2	Unknown	O. A. Wolcott
Clinton	Saranac	7	Ethel L. Stewart	O. A. Wolcott
Clinton	Saranac	8	Ruth Davidson	O. A. Wolcott
Clinton	Saranac	9	Unknown	O. A. Wolcott
Clinton	Saranac	10	Mae O'Connell	O. A. Wolcott
Clinton	Saranac	18	Julia M. Strack	O. A. Wolcott
Clinton	Schuyler Falls	1	Ellen M. Downs	O. A. Wolcott
Clinton	Schuyler Falls	5	Caroline L. Pierce	O. A. Wolcott
Clinton	Schuyler Falls	8	Winifred M. Bromley	O. A. Wolcott
Clinton	Unknown	..	Ursula Suprenant	O. A. Wolcott
Clinton	Unknown	Unknown	Unknown	O. A. Wolcott
Columbia	Ancram	6	Jennie W. Rossman	E. A. Smith
Cortland	Lapeer	7	K. Lou Uptegrove	Alice Greene
Delaware	Tompkins	12	Etta M. Howard	Lillian Reichard
Delaware	Walton	6	Katharine E. Neish	E. C. Harkness
Dutchess	Clinton	7	Ella K. Cozina	Clara Drum
Erie	Clarence	1	Peter Long, Jr	C. A. Heist
Erie	Eden	7	Mrs. C. R. Smith	E. D. Ormsby
Essex	Minerva	2	Margaret Lynch	C. J. Mousaw
Fulton	Johnstown	1	Bessie Snow	F. A. Stryker
Fulton	Perth	6	Charlottie Shattuck	C. B. Van Buren
Fulton	Unknown	Unknown	Unknown	C. B. Van Buren
Genesee	Alexander	4	Wilhelmina Kennedy	E. M. McCullough
Genesee	Stafford	2	Charlotte L. Daniels	T. A. Clement
Greene	Catskill	13	Marguerite Buckman	T. C. Perry
Jefferson	Ellisburg	12	Lena B. Davis	C. M. Pierce
Jefferson	Hounsfield	10	Margaret I. Baker	R. W. Bowman
Lewis	Grieg	7	Gertrude L. Lonas	Ruth Johnston
Lewis	Lyansdale	5	Erma F. J. Dunn	Ruth Johnston
Lewis	Martinsburg	7	Julia Coffey	Ruth Johnston
Lewis	Turin	2	G. Marion Hess	Ruth Johnston
Livingston	Caledonia	3	Agnes Morrisey	J. P. Magee
Livingston	Livonia	9	Virginia Zimmer	J. F. Smith
Madison	Cazenovia	12	Mrs. E. Van Buskirk	C. J. Wratten
Madison	Fenner	4	Clara F. Deane	C. J. Wratten
Madison	Nelson	8	Una E. Wearer	C. J. Wratten
Madison	Eaton	5	Mary Tucker	H. C. W. Kingsbury
Madison	Eaton	8	Maude S. Setchel	H. C. W. Kingsbury
Madison	Madison	1	Prin. H. J. Coon	H. C. W. Kingsbury
Madison	Madison	11	Blanche V. Davis	H. C. W. Kingsbury
Madison	Smithfield	1	Prin. H. G. Bishop	H. C. W. Kingsbury
Madison	Smithfield	7	Carrie E. Miller	H. C. W. Kingsbury
Madison	Stockbridge	1	Prin. B. G. Brennan	H. C. W. Kingsbury
Madison	Lenox	2	N. Maud Beebee	D. Keating
Madison	Lincoln	1	Florence Case	D. Keating

County	Town	District	Teacher	District superintendent
Madison	Lincoln	2	N. Alice Phipps	D. Keating
Madison	Lincoln	4	Florence Rogers	D. Keating
Madison	Oneida	2	Mrs. A. Durkee	D. Keating
Madison	Oneida	3	Isabel Eames	D. Keating
Madison	Oneida	6	E. Eliza Walters	D. Keating
Madison	Oneida	7	Gladys Farley	D. Keating
Madison	Sullivan	1	A. I. Tyler	D. Keating
Madison	Sullivan	3	Erma M. Hall	D. Keating
Madison	Sullivan	4	Lefa M. Cook	D. Keating
Madison	Sullivan	12	Olive E. Fletcher	D. Keating
Madison	Sullivan	18	Ruth Coyle	D. Keating
Monroe	Brighton	9	Florence A. Taylor	W. W. Rayfield
Monroe	Henrietta	4	Ethel Schillinger	W. W. Rayfield
Monroe	Henrietta	6	Mary Ward	W. W. Rayfield
Monroe	Henrietta	9	Emma E. Sherman	W. W. Rayfield
Monroe	Henrietta	10	Mrs. Frank Abbott	W. W. Rayfield
Monroe	Irondequoit	4	Charles W. Joyce	W. W. Rayfield
Monroe	Penfield	2	Joseph M. Schnitzer	W. W. Rayfield
Monroe	Webster	3	Arlington Swarts	W. W. Rayfield
Monroe	Webster	4	Bertha Barringer	W. W. Rayfield
Monroe	Webster	9	Florence Stanton	W. W. Rayfield
Monroe	Mendon	2	Gertrude Jones	M. B. Furman
Monroe	Mendon	4	Lucelia E. Martin	M. B. Furman
Monroe	Mendon	6	Mary L. Martin	M. B. Furman
Monroe	Mendon	9	Florence L. Blood	M. B. Furman
Monroe	Mendon	13	Elizabeth R. Bailey	M. B. Furman
Monroe	Mendon	15	Mae Blood	M. B. Furman
Monroe	Mendon	17	Elizabeth A. Courneen	M. B. Furman
Monroe	Perinton	1	Ida M. Campbell	M. B. Furman
Monroe	Perinton	4	Mary H. Harrigan	M. B. Furman
Monroe	Perinton	11	Annie T. Neary	M. B. Furman
Monroe	Perinton	12	Florence Peters	M. B. Furman
Monroe	Pittsford	3	Carrie Stebbins	M. B. Furman
Monroe	Pittsford	7	Alma F. Papka	M. B. Furman
Monroe	Rush	5	Anna F. Marshall	M. B. Furman
Monroe	Rush	6	Jennie Maitland	M. B. Furman
Monroe	Clarkson	1	Pearl L. Baxter	F. W. Hill
Monroe	Clarkson	3	Esther S. Bahls	F. W. Hill
Monroe	Clarkson	9	May E. Humphrey	F. W. Hill
Monroe	Clarkson	10	Nellie L. Mills	F. W. Hill
Monroe	Greece	7	W. H. Frisbee	F. W. Hill
Monroe	Greece	10	Jessie H. Baird	F. W. Hill
Monroe	Greece	13	E. T. P. Ryel	F. W. Hill
Monroe	Greece	16	Anna Wenrich	F. W. Hill
Monroe	Hamlin	4	Ruth I. Wheaton	F. W. Hill
Monroe	Hamlin	7	Emma R. Look	F. W. Hill
Monroe	Hamlin	10	Zetta E. Knapp	F. W. Hill
Monroe	Hamlin	11	Mabel C. Wade	F. W. Hill
Monroe	Parma	5	Mrs. Jennie C. McKinney	F. W. Hill
Monroe	Parma	7	J. E. Mackey	F. W. Hill
Monroe	Parma	9	John W. Cosman	F. W. Hill
Monroe	Parma	11	May Mills	F. W. Hill
Monroe	Sweden	1	Marguerite True	F. W. Hill
Monroe	Sweden	7	Mrs. Ruth B. Young	F. W. Hill
Monroe	Chili	3	Anne Emerson	J. C. Malloch
Monroe	Gates	2	Catharine Donohue	J. C. Malloch
Monroe	Gates	7	Mary E. Dodd	J. C. Malloch
Monroe	Riga	5	Clara G. Walker	J. C. Malloch
Monroe	Riga	6	Frances E. Hill	J. C. Malloch
Monroe	Riga	8	Hilda L. Ash	J. C. Malloch
Monroe	Riga	10	Olive A. Kennedy	J. C. Malloch
Monroe	Wheatland	2	Bertrice M. Talbot	J. C. Malloch
Monroe	Wheatland	4	Hazel Stokoe	J. C. Malloch
Montgomery	Canajoharie	8	Ellen S. G. Vaughan	N. B. Alter
Montgomery	Florida	5	R. Annah Dorn	Mrs. Lela Dodge
Nassau	North Hempstead	8	Florence V. Bellew	J. S. Cooley
Nassau	Oyster Bay	13	Carrie B. Fish	J. S. Cooley
Nassau	Oyster Bay	23	Mary T. Hefferman	J. S. Cooley
Niagara	Lewiston	12	Rachel Powell	W. D. Wisner
Oneida	Sangerfield	9	J. Minnie Burleson	H. C. Buck
Oneida	Camden	4	Fred H. Swanson	Pauline L. Scott
Onondaga	Clay	15	Julia M. Luke	E. E. McDowell
Ontario	West Bloomfield	6	Mary Rigney	L. J. Cook
Ontario	West Bloomfield	7	May A. Leary	L. J. Cook
Ontario	Geneva	7	Mary E. Dowd	E. G. Soper
Ontario	Gorham	4	Louise Hoyt	E. G. Soper
Ontario	Gorham	6	H. W. Raymer	E. G. Soper
Ontario	Gorham	8	Alice J. Johncox	E. G. Soper
Ontario	Gorham	11	Clara A. Raymond	E. G. Soper
Ontario	Gorham	13	Alida Dear	E. G. Soper
Ontario	Gorham	14	Nellie Harris	E. G. Soper
Ontario	Gorham	15	Mary A. Phelps	E. G. Soper

County	Town	District	Teacher	District superintendent
Ontario	Gorham	16	Alma Reynolds	E. G. Soper
Ontario	Hopewell	7	Janet K. Buchan	E. G. Soper
Ontario	Hopewell	9	Julia C. Caplise	E. G. Soper
Ontario	Hopewell	10	Lilla M. Kinnear	E. G. Soper
Ontario	Seneca	1	Mrs. Katharine B. Fraher	E. G. Soper
Ontario	Seneca	7	Mrs. Edward Hall	E. G. Soper
Ontario	Seneca	11	Susan Moore	E. G. Soper
Orleans	Shelby	1	Mabel J. Mosher	Luella P. Hoyer
Orleans	Richland	3	Mrs. M. A. Weeden	J. M. Bonner
Orleans	Williamstown	3	Bessie Stiles	J. M. Bonner
Orleans	Williamstown	8	Mary E. Finnerty	J. M. Bonner
Orleans	Constantia	6	Flossie A. Talcott	Miss Q. R. Tooley
Otsego	Cherry Valley	5	Hazel Wilson	H. Cossaart
Otsego	Middlefield	3	Margaret C. King	H. Cossaart
Otsego	Middlefield	5	Clarissa G. Adair	H. Cossaart
Otsego	Middlefield	6	Kathleen A. Lynch	H. Cossaart
Otsego	Middlefield	8	Pearl M. Chase	H. Cossaart
Otsego	Westford	3	Irving Groff	M. Burlingame
Otsego	Milford	8	Evelyn E. Halsey	May Firman
Otsego	Oneonta	7	Bessie Norris	May Firman
Otsego	New Lisbon	6	Mrs. Attie E. Harrington	M. R. Porter
Rensselaer	Brunswick	1	Elizabeth Schneider	Mrs. C. B. Clark
Rensselaer	Hoosick	17	Myrta Laker	Mrs. C. B. Clark
Rensselaer	Pittston	9	Catharine Cullinana	Mrs. C. B. Clark
Rensselaer	Berlin	4	Alice Bannon	C. H. Maher
Rensselaer	Stephentown	6	Florence Reynolds	C. H. Maher
Rensselaer	East Greenbush	1	Mary McDonough	G. W. Patterson
Saratoga	Milton	3	Anna M. Shayne	Lou Messinger
Saratoga	Moreau	7	Helen C. Littlejohn	E. E. Hinman
Saratoga	Moreau	8	Ada C. Orcutt	E. E. Hinman
Saratoga	Moreau	9	Emma Cahill	E. E. Hinman
Saratoga	Moreau	9	Lena A. Wilson	E. E. Hinman
Saratoga	Northumberland	2	Katharine E. McCarty	E. E. Hinman
Saratoga	Northumberland	5	Josephine M. Ransome	E. E. Hinman
Saratoga	Northumberland	6	J. Florence Stearns	E. E. Hinman
Saratoga	Northumberland	6	Mary McDonald	E. E. Hinman
Saratoga	Saratoga	1	Prin. A. E. Marsh	E. E. Hinman
Saratoga	Saratoga	2	Caroline E. Peck	E. E. Hinman
Saratoga	Saratoga	4	Mary A. Kelley	E. E. Hinman
Saratoga	Saratoga	5	Grace E. Davenport	E. E. Hinman
Saratoga	Saratoga	7	Frances M. Gilhouse	E. E. Hinman
Saratoga	Saratoga	8	Margaret A. FitzGibbon	E. E. Hinman
Saratoga	Saratoga	9	Esther A. Murray	E. E. Hinman
Saratoga	Saratoga	11	Catharine C. Cohan	E. E. Hinman
Saratoga	Saratoga Spa	2	Mary E. Carman	E. E. Hinman
Saratoga	Saratoga Spa	5	Mary C. Breen	E. E. Hinman
Saratoga	Saratoga Spa	7	Hattie M. Seaman	E. E. Hinman
Saratoga	Wilton	5	Lora M. Burnham	E. E. Hinman
Saratoga	Wilton	6	Marion A. Hodges	E. E. Hinman
Saratoga	Corinth	2	Mina Angell	Ida M. Smith
Saratoga	Corinth	4	Jessie L. Clothier	Ida M. Smith
Saratoga	Corinth	5	Lois F. Belden	Ida M. Smith
Saratoga	Corinth	6	Ethel Mosher	Ida M. Smith
Saratoga	Corinth	8	Susie L. Gray	Ida M. Smith
Saratoga	Corinth	9	Hattie M. Andrews	Ida M. Smith
Saratoga	Corinth	Unknown	Unknown	Ida M. Smith
Saratoga	Day	1	Mildred E. Combs	Ida M. Smith
Saratoga	Day	2	Josie L. Smith	Ida M. Smith
Saratoga	Day	3	Lena M. Gilroy	Ida M. Smith
Saratoga	Day	4	Grace E. George	Ida M. Smith
Saratoga	Day	5	M. Ethelyn Devine	Ida M. Smith
Saratoga	Edinburg	2	Ruby M. Lawton	Ida M. Smith
Saratoga	Edinburg	5	Carl Fraker	Ida M. Smith
Saratoga	Edinburg	9	Mrs. G. A. E. Mosher	Ida M. Smith
Saratoga	Edinburg	10	Isabel Jordan	Ida M. Smith
Saratoga	Greenfield	1	Gladys A. Smith	Ida M. Smith
Saratoga	Greenfield	3	Maude M. Post	Ida M. Smith
Saratoga	Greenfield	4	Lizzie M. Cohan	Ida M. Smith
Saratoga	Greenfield	8	Edyth W. Winney	Ida M. Smith
Saratoga	Greenfield	Unknown	Unknown	Ida M. Smith
Saratoga	Hadley	5	Elsie McArthur	Ida M. Smith
Saratoga	Hadley	6	Katharine Fenton	Ida M. Smith
Saratoga	Hadley	7	Orpha Ross	Ida M. Smith
Schoharie	Esperance	1	R. B. Rockwell	W. E. Van Wormer
Schoharie	Esperance	5	George W. Finch	W. E. Van Wormer
Schoharie	Esperance	8	Olive N. Jones	W. E. Van Wormer
Schoharie	Fulton	10	Lena Graham	W. E. Van Wormer
Schoharie	Middleburg	3	Charles D. West	W. E. Van Wormer
Schoharie	Middleburg	10	Hazel D. Dreisbeck	W. E. Van Wormer
Schoharie	Schoharie	3	Edna M. Van Voris	W. E. Van Wormer
Schoharie	Schoharie	8	Marcus R. Zeh	W. E. Van Wormer

County	Town	District	Teacher	District superintendent
Schoharie	Wright	7	Everett J. Becker	W. E. Van Wormer
Schoharie	Richmondville	7	Agnes J. Meade	R. W. Eldredge
Schuyler	Hector	23	Harry Coats	Alberta Spaulding
Seneca	Fayette	6	Eva M. Durkin	C. B. Earl
Seneca	Fayette	7	Anna E. McKeon	C. B. Earl
Seneca	Fayette	11	Margaret Mahoney	C. B. Earl
Seneca	Fayette	15	Edward F. Bannister	C. B. Earl
Seneca	Junius	1	Pearl Heit	C. B. Earl
Seneca	Seneca Falls	2	Marie Reagan	C. B. Earl
Seneca	Tyre	9	Bertha M. Bordner	C. B. Earl
Seneca	Waterloo	3	Honor E. Williams	C. B. Earl
Steuben	Erwin	3	Grace O. Miller	Levi R. Tubbs
Steuben	Lindley	3	George M. Riffle	Levi R. Tubbs
Steuben	Bath	24	Ila Cook	W. Morrow
Steuben	Woodhull	3	Mary E. Symonds	G. H. Guinnip
Steuben	Jasper	15	Rosalie Fieger	F. C. Wilcox
Steuben	Troupsburg	7	Florence M. Price	F. C. Wilcox
Steuben	Canisteo	10	Margaret E. Brotzman	H. M. Brush
Steuben	Avoca	5	Minnie M. Stanton	G. J. Carter
Steuben	Howard	16	Mary J. Dascomb	G. J. Carter
Steuben	Wayland	6	Nina A. Schwingel	G. J. Carter
Steuben	Urbana	1	Fanny L. Sincebox	J. J. McConnell
Suffolk	East Hampton	2	Margaret Swobe	C. H. Howell
Suffolk	East Hampton	4	James G. Westcott	C. H. Howell
Suffolk	Riverhead	3	Lulu B. Fanning	C. H. Howell
Suffolk	Riverhead	4	Emma J. Dority	C. H. Howell
Suffolk	Riverhead	11	Viola E. Corwin	C. H. Howell
Suffolk	Riverhead	12	Sarah E. Wells	C. H. Howell
Suffolk	Riverhead	Unknown	Unknown	C. H. Howell
Suffolk	Southampton	1	Harry L. Squires	C. H. Howell
Suffolk	Southampton	4	J. H. Goodale	C. H. Howell
Suffolk	Southampton	7	W. C. Raynor	C. H. Howell
Suffolk	Southampton	8	Anna A. Rogers	C. H. Howell
Suffolk	Southampton	10	Helen J. Ludlow	C. H. Howell
Suffolk	Southampton	13	Maude M. Becker	C. H. Howell
Suffolk	Southampton	15	Katharine P. Tuttle	C. H. Howell
Suffolk	Southampton	18	Lucretia H. Hand	C. H. Howell
Suffolk	Southold	3	Marvin M. Brooks	C. H. Howell
Suffolk	Southold	7	Francis Miles	C. H. Howell
Suffolk	Southold	8	M. Alice Taft	C. H. Howell
Suffolk	Southold	11	Annie Halsey	C. H. Howell
Suffolk	Brookhaven	18	Elizabeth A. Hallock	J. H. Young
Suffolk	Brookhaven	31	Edith L. Smith	J. H. Young
Sullivan	Bethel	5	Alice I. Ruddick	F. J. Lewis
Sullivan	Fallsburgh	1	Mrs. C. M. Wilson	Mrs. E. Chase
Tioga	Candor	22	Alice C. Van Scoy	A. E. Belden
Tioga	Tioga	12	Susie M. Brink	M. D. Goodrich
Tompkins	Enfield	2	Martha T. Smith	F. A. Beardsley
Tompkins	Enfield	7	Fanny L. Curtis	F. A. Beardsley
Tompkins	Enfield	11	Mrs. H. S. Curry	F. A. Beardsley
Tompkins	Newfield	1	Pearl S. Houston	F. A. Beardsley
Tompkins	Newfield	3	Mary A. Beardsley	F. A. Beardsley
Tompkins	Newfield	8	Ethel Baker	F. A. Beardsley
Tompkins	Newfield	15	Grace M. Sabin	F. A. Beardsley
Tompkins	Newfield	18	Katharine Alexander	F. A. Beardsley
Tompkins	Newfield	21	Chloe James	F. A. Beardsley
Tompkins	Ulysses	6	Helen E. Fish	F. A. Beardsley
Tompkins	Ulysses	15	Anna W. Clawson	F. A. Beardsley
Tompkins	Groton	21	Unknown	Mrs. Hattie Buck
Tompkins	Ithaca	1	Flora M. Huntington	Mrs. Hattie Buck
Tompkins	Ithaca	8	Carrie Andrews	Mrs. Hattie Buck
Tompkins	Caroline	2	Mildred Card	J. D. Bigelow
Tompkins	Caroline	3	Lucy S. Weston	J. D. Bigelow
Tompkins	Caroline	4	Mary Cuykendall	J. D. Bigelow
Tompkins	Caroline	6	Elosia M. Lyme	J. D. Bigelow
Tompkins	Caroline	7	Mrs. Ella M. Slater	J. D. Bigelow
Tompkins	Caroline	9	Lena M. Jansen	J. D. Bigelow
Tompkins	Caroline	11	Edith L. Howell	J. D. Bigelow
Tompkins	Caroline	14	Georgia L. Head	J. D. Bigelow
Tompkins	Caroline	15	Mrs. E. N. Snow	J. D. Bigelow
Tompkins	Caroline	16	Jane E. Tupper	J. D. Bigelow
Tompkins	Caroline	17	Martha M. Preston	J. D. Bigelow
Tompkins	Caroline	18	Martha E. Quick	J. D. Bigelow
Tompkins	Caroline	19	Rhea F. Ross	J. D. Bigelow
Tompkins	Caroline	21	Bessie L. Gridley	J. D. Bigelow
Tompkins	Caroline	21	Mrs. Sue Earsley	J. D. Bigelow
Tompkins	Caroline	21	Maude Knettles	J. D. Bigelow
Tompkins	Caroline	21	Nellie A. Sickman	J. D. Bigelow
Tompkins	Danby	1	Nellie Davis	J. D. Bigelow
Tompkins	Danby	2	Alice Mead	J. D. Bigelow
Tompkins	Danby	4	Zenas S. Snyder	J. D. Bigelow
Tompkins	Danby	5	Gertrude Huntington	J. D. Bigelow

County	Town	District	Teacher	District superintendent
Tompkins	Danby	6	Lena B. Whipple	J. D. Bigelow
Tompkins	Danby	7	Olive F. Fisher	J. D. Bigelow
Tompkins	Danby	8	Harriet M. Hough	J. D. Bigelow
Tompkins	Danby	9	Jennie F. Allick	J. D. Bigelow
Tompkins	Danby	10	Mrs. Olivia Jones	J. D. Bigelow
Tompkins	Danby	11	Grace R. Parker	J. D. Bigelow
Tompkins	Danby	12	Mrs. Lewis Thatcher	J. D. Bigelow
Tompkins	Danby	13	Adah Barto	J. D. Bigelow
Tompkins	Danby	14	L. L. Loomis	J. D. Bigelow
Tompkins	Danby	15	Maude E. Tupper	J. D. Bigelow
Tompkins	Danby	16	Nina A. Huslander	J. D. Bigelow
Tompkins	Dryden	2	Kathryn Hazen	J. D. Bigelow
Tompkins	Dryden	3	Sue E. Monroe	J. D. Bigelow
Tompkins	Dryden	4	Bertha M. Matison	J. D. Bigelow
Tompkins	Dryden	5	Margaret J. Ashlin	J. D. Bigelow
Tompkins	Dryden	7	S. Cady Knapp	J. D. Bigelow
Tompkins	Dryden	8	Prin. E. G. Burch	J. D. Bigelow
Tompkins	Dryden	10	Elizabeth M. Griffin	J. D. Bigelow
Tompkins	Dryden	11	Mary E. Burgess	J. D. Bigelow
Tompkins	Dryden	12	Mrs. Elva H. Caswell	J. D. Bigelow
Tompkins	Dryden	13	Prin. L. E. Heinmiller	J. D. Bigelow
Tompkins	Dryden	14	Mary A. Van Marter	J. D. Bigelow
Tompkins	Dryden	15	Clara E. Smiley	J. D. Bigelow
Tompkins	Dryden	16	Ida M. Townley	J. D. Bigelow
Tompkins	Dryden	17	Ethel D. Lane	J. D. Bigelow
Tompkins	Dryden	18	Jessie K. Spaulding	J. D. Bigelow
Tompkins	Dryden	19	Charlotte Slights	J. D. Bigelow
Tompkins	Dryden	20	Mildred Schutt	J. D. Bigelow
Tompkins	Dryden	21	Josephine Gardner	J. D. Bigelow
Tompkins	Dryden	23	Nita M. Hall	J. D. Bigelow
Tompkins	Dryden	24	Leah English	J. D. Bigelow
Tompkins	Dryden	25	Libbie J. Sweetland	J. D. Bigelow
Tompkins	Dryden	26	Charlotte L. Thomas	J. D. Bigelow
Tompkins	Dryden	27	Prin. Gregory Andrews	J. D. Bigelow
Ulster	Wawarsing	25	Rosa A. Freer	J. M. Schoonmaker
Warren	Caldwell	5	Mrs. J. W. Wood	F. F. Gunn
Warren	Luzerne	4	Ethel C. Grey	F. F. Gunn
Warren	Luzerne	7	Gertrude M. Dunn	F. F. Gunn
Warren	Luzerne	8	Sara P. Dunn	F. F. Gunn
Warren	Luzerne	10	Beatrice McGraw	F. F. Gunn
Warren	Queensbury	4	Mrs. Caroline L. Harris	F. F. Gunn
Warren	Queensbury	6	Kate P. Cooper	F. F. Gunn
Warren	Queensbury	10	Lida H. Burton	F. F. Gunn
Warren	Queensbury	12	Doris E. Hodgin	F. F. Gunn
Warren	Queensbury	16	M. M. Tucker	F. F. Gunn
Warren	Queensbury	17	Kate Howe	F. F. Gunn
Warren	Queensbury	19	Marion D. Hendryx	F. F. Gunn
Warren	Queensbury	21	Florence Booth	F. F. Gunn
Warren	Warrensburg	7	Gladys Steves	F. F. Gunn
Warren	Warrensburg	8	Helen E. Chadwick	F. F. Gunn
Washington	Hartford	5	Charles Qua	Myra Ingalsbe
Washington	Argyle	1	Julia Saunders	Mary Potter
Washington	Cambridge	14	Elizabeth V. Tighe	F. H. Rich
Washington	White Creek	1	James T. Allen	F. H. Rich
Washington	White Creek	6	Cora A. Potter	F. H. Rich
Washington	White Creek	7*	Bertha M. Frisbie	F. H. Rich
Wayne	Arcadia	12	Catharine C. Beck	Mrs. H. Andrews
Wayne	Arcadia	19	Minnie R. Hoeltzel	Mrs. H. Andrews
Wayne	Galen	2	Lizzie H. Malchoff	Mrs. H. Andrews
Wayne	Galen	9	Ollie Hendricks	Mrs. H. Andrews
Wayne	Galen	13	Bertha Radcliffe	Mrs. H. Andrews
Wayne	Lyons	7	Emma J. Hall	Mrs. H. Andrews
Wayne	Savannah	6	J. A. Craw	Mrs. H. Andrews
Wayne	Savannah	11	Flossie B. Holdredge	Mrs. H. Andrews
Wayne	Butler	1	Blanche Chapin	Mrs. Ida Cosad
Wayne	Huron	2	Josephine York	Mrs. Ida Cosad
Wayne	Huron	3	Bessie Olmsted	Mrs. Ida Cosad
Wayne	Huron	5	Bertha O. Smith	Mrs. Ida Cosad
Wayne	Huron	10	Gertrude Kerr	Mrs. Ida Cosad
Wayne	Wolcott	11	Myrtle Bailey	Mrs. Ida Cosad
Yates	Starkey	3	Mrs. Amy J. Drummond	J. F. Bullock
Unknown	Unknown	Unknown	Unknown	Unknown

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* Prize ear of flint corn.

SUGGESTIONS FOR LESSONS

COWS

Have a week for the study of cows and see how much you can learn concerning the dairy interests in your community. The following suggestions will be helpful:

1. From an outline drawing of a cow made on the blackboard, ask your teacher to test your knowledge of the parts of a cow as listed on page 52 of the teachers' leaflet.

2. Let every one practice making drawings of the beef type of cow and of the dairy type, as illustrated on page 225 of this leaflet. Then some afternoon ask your teacher to test your knowledge of the two types of cows by having you draw them from memory. Be sure that your drawing of the dairy type shows the *wedge-shaped body*, the *refined head*, and the *well-developed udder;* and that the drawing of the beef type shows the *rectangular body*, *thick neck*, and *small udder*.

3. Make an exhibit of the different kinds of foods given to cattle and learn from a farmer about the value of these foods. Perhaps during the week when you are learning about cows, a successful dairy farmer will come to the school and talk about cattle and dairy products and about certain practices that are essential on a successful dairy farm.

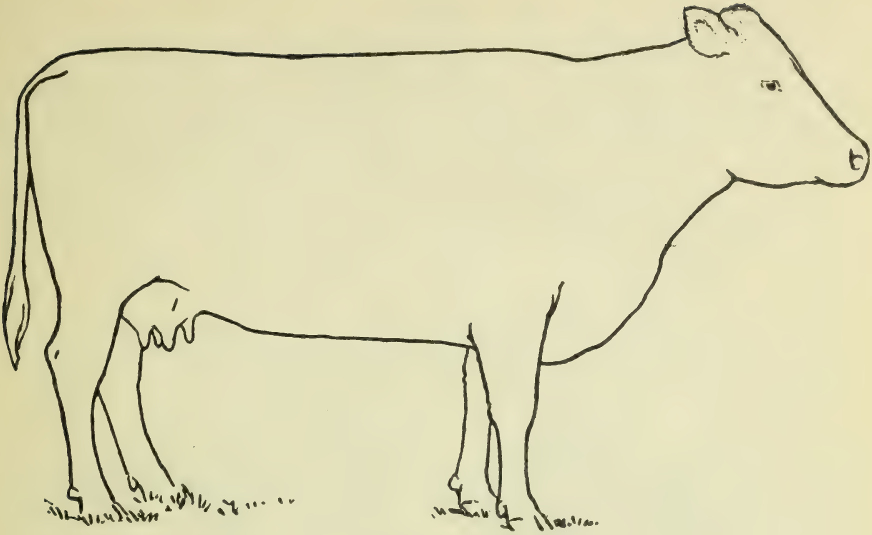
4. What boy or girl can write the best composition on the importance of clean milk and how it can be kept clean?

5. If you have a Babcock milk-tester in your school, test the milk of the different cows in your home herd.

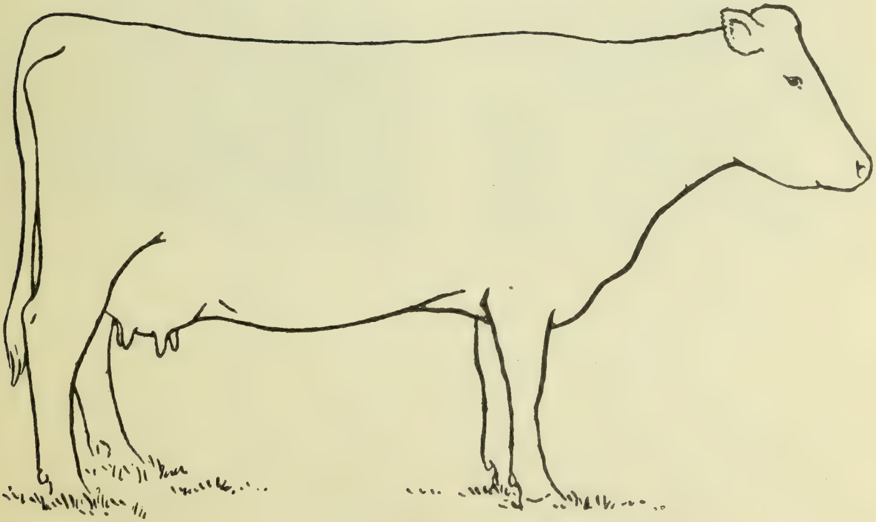
6. Find out how many cows there are in your district. How many breeds are represented? How many pure-bred cows are there? Who has the most valuable cow?

7. Make a scrapbook in which can be kept valuable information about cattle: your own observations neatly written, articles and pictures from farm journals, and the like. This will be of value for your class and for the classes that will come later.

In all your study of agriculture remember that it is important to gain information from observation of weather and soils and plants and animals, or from actual experimental work, instead of by reading or learning facts from a printed page. Books will help you and give suggestions for study, but successful farmers have been students of nature. In your study of cows, therefore, try to learn as much as possible from your own observations of them; and when any questions arise that you cannot answer, ask your teacher or a good dairyman to help you.



Beef type

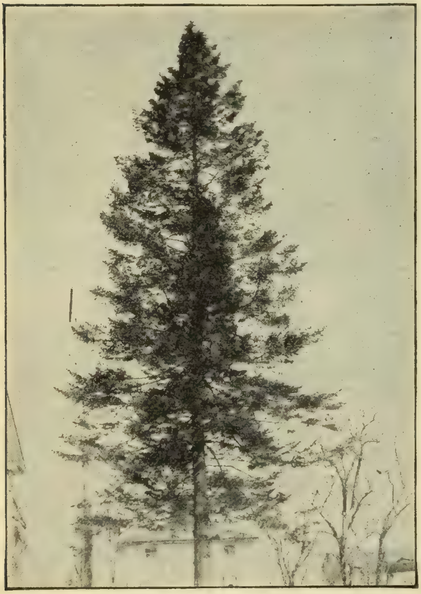


Dairy type

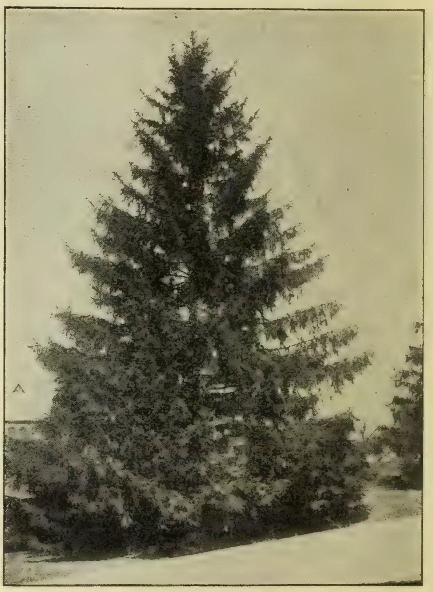
TREES

In winter we can study the evergreen trees. How many kinds have you in your neighborhood? By patient search and by inquiry try to see the following trees this year and to have specimens in school for study: the *white pine*, the *pitch pine*, the *balsam fir*, and the *Norway spruce*. In the pitch pine the needles are in clusters of *three*, in the white pine in clusters of *five*. The balsam fir and the Norway spruce can be distinguished as follows:

	Balsam fir		*Norway spruce*
Bark........	Light gray; blisters which contain resin, called Canada balsam, on bark;	Bark........	Reddish gray; no resin blisters
Cones......	When young, dark purple; later, brown. Stand erect on branch	Cones.......	Long, light brownish yellow. Hang down on branch
Needles....	Flat; a light gray streak on the underside	Needles.....	Four-sided



Balsam fir

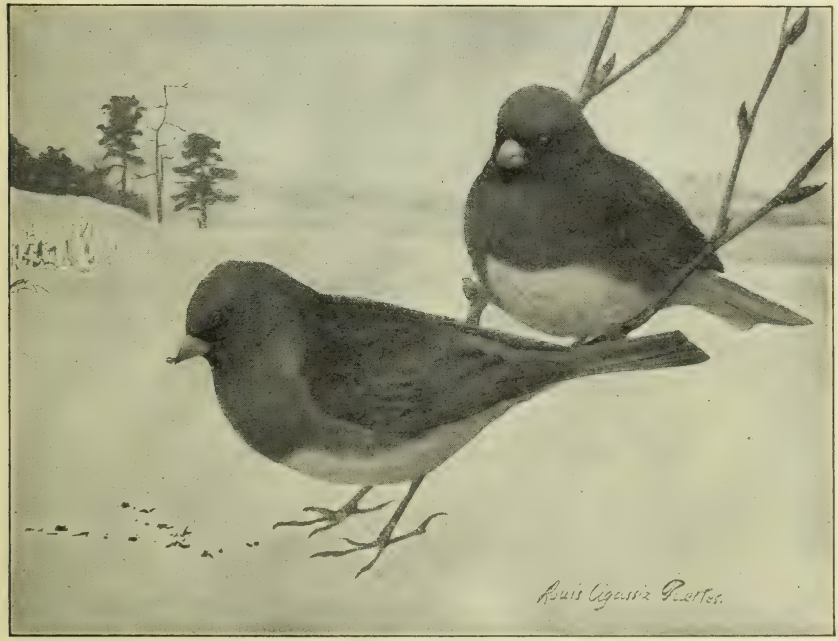


Norway spruce

BIRDS

The list of birds for study this year is as follows: *robin*, *junco*, *song sparrow*, *wren*, *ovenbird*, *chimney swift*, *wood thrush*, *sandpiper*, *flicker*, *catbird*, and *guinea fowl*. We must wait until next spring to study most of them, but we may see the junco this winter. It is a slaty-colored bird with white belly, and when flying shows white tail feathers. We may also see a song sparrow in winter, and perhaps a robin.

In addition to the birds listed above we shall study two winter birds. One or more of the following may be seen: crow, tree sparrow, kinglet, winter wren, longspur, crossbill, red poll, snow bunting, downy woodpecker, hairy woodpecker, blue jay, flicker, nuthatch, chickadee, owl, shrike, gull. Make two lists of these winter birds, one of those that you know and the other of those that you have never seen. Read in a good bird book descriptions of the winter birds that you do not know, and then be on the lookout for them.

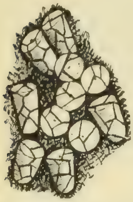


Junco

Be sure to make a Christmas tree for the birds. Hang suet or meat bones to the branches of trees, out of the reach of cats. Scatter seeds for the seed-eating birds. Supply water whenever possible. Plan to have some evergreen shrubbery planted near your home and your school for the birds next year.

AN INSECT ENEMY

Doubtless boys and girls everywhere in New York State noticed the great number of nests of the apple-tree tent-caterpillars last spring. Perhaps efforts were made to destroy the nests, but this is not an easy thing to do and many thousands escaped destruction. Consequently great numbers of the caterpillars developed into adult moths which, in turn, have laid countless clusters of eggs that will be a serious menace when they hatch next spring unless they are destroyed.

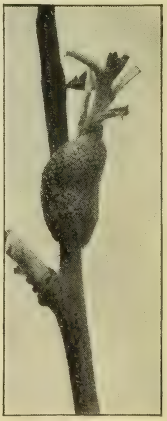


Eggs (enlarged)

No life should be needlessly or thoughtlessly destroyed. At the same time it is necessary to destroy life that threatens to ruin farm products. When such a necessity arises, the method of control that will be most certain and most humane should be sought. It is not good to kill. The impression that it makes on the human mind is one that might well be avoided. If life must be taken, however, every one should know how to take it quickly and with the least torture.

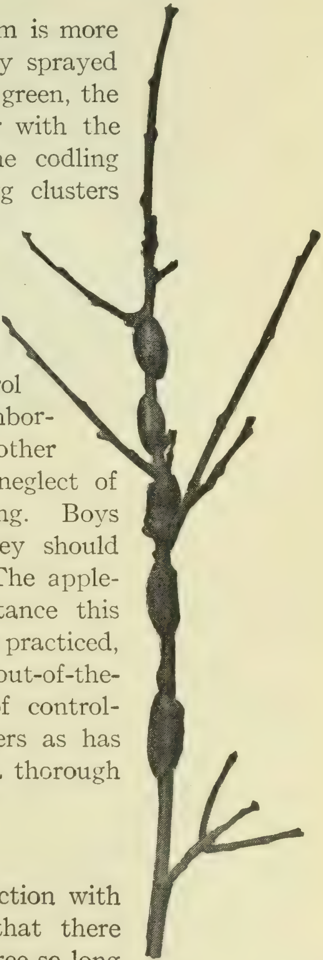
For this reason, burning the nests of the tent-caterpillars is not the best way to control this enemy of our fruit trees. It is not best because there is another and a better way, which is to destroy the egg clusters in the fall. Moreover, each small egg mass left unmolested in the fall will produce a large nest in the spring.

The egg clusters of the apple-tree tent-caterpillar are usually on slender twigs at the ends of branches. The eggs themselves are white and thimble-shaped; but several hundred of them are fastened together around the twig, and the whole is covered with a waterproof glue-like substance very much the color of the bark so that it is not easy to distinguish the cluster. It appears to be a little swelling on the twig. The illustrations give an idea of the eggs enlarged, of a close view of the cluster, and of the appearance of a twig with several clusters as seen from a little distance.



Egg mass

Now is the time to remove the egg clusters, cutting the twig off just below them and burning it. Great service can be done by the young folk and at the same time a lesson in the control of injurious insect life can be learned. The egg clusters will be found mostly on apple trees, both cultivated and wild, and on chokecherry and wild black cherry trees. In some parts of the State the latter two are very abundant along hedgerows and fences, in the edges of woods and thickets, in pastures and like places. Neither cherry is of particular value and, wherever possible, it is well to take out the whole tree and burn it. If this work cannot actually be done by the boys and girls, they can search for the wild trees and bring the matter to the attention of their parents.



With the cultivated apple trees the problem is more difficult. Wherever the trees are thoroughly sprayed in the spring with arsenate of lead or paris green, the young tent-caterpillars will be killed, together with the larvæ of the injurious bud moth and the codling moth. If spraying is not practiced, the egg clusters should be removed from the tree in the fall even at the risk of injuring the tree, for greater injury and loss will result if the caterpillars are allowed to hatch and develop.

There is a social problem connected with insect pests. A farmer who neglects to control a pest on his farm is injuring the entire neighborhood as much as if he should commit any other serious offence. The same rule applies to neglect of plant diseases or weeds or any harmful thing. Boys and girls should understand this and they should learn to assist in the control of pests. The apple-tree tent-caterpillar is of particular importance this year. Whenever universal spraying cannot be practiced, as it cannot be in the case of wild trees in out-of-the-way places, the quick and sensible method of controlling this enemy is to destroy the egg clusters as has been suggested. Let every school help in a thorough way.

The mention of wild apple trees in connection with the tent-caterpillars brings the thought that there should not be such a thing as a wild apple tree so long as there is a real live boy or girl anywhere near. It is not difficult to graft trees, and each year something can be done toward making the wild trees along the roadsides produce a good variety of fruit. Why not give every apple tree the opportunity to produce the best kind of fruit? Plan for this by finding out what apples in the neighborhood are best, at what season the trees should be grafted, and how the grafting may be done. This information can be obtained from some farmer who takes good care of his fruit trees.

THANKSGIVING DAY

Long ago there was a little schoolhouse that stood beside a straight white road. To the left were low meadows; to the right, a bit of woodland in which a few pines grew. The school building was old and very plain, and in winter the floors were cold and the wind came sweeping around, rattling the windows and whistling in the chimney until it made strange music.

There were many happy hours in this old schoolhouse, but perhaps the best time of all was Thanksgiving. Throughout the week there was so much to think about and so much to do, for Thanksgiving in the country is very different indeed from Thanksgiving in the city; and how can any one really appreciate this great American holiday unless he has taken part in the harvest time? One must see the goodly stores gathered in for winter. He must look out over the great stretches of farm land and feel the wonder-color found only in the late autumn — the browns, the yellows, the hemlock greens and all the other greens, the bittersweet vine lending its touch of scarlet. He must feel the stillness over all. He must look forward to the time when the north wind will blow in his face and he will watch the first snowflakes fall, not on the roofs of the city, but on the quiet fields and on the trees and the fences and the weedy stalks.

The boys and girls in the old schoolhouse loved the country; and their teacher loved it, too, and they were all in the spirit to make the week of Thanksgiving as full of interest and of joy as possible. Perhaps many of our boys and girls to-day would like to do some of the things that the young folk in that rural district did to make the autumn holiday very happy and very profitable.

In the first place they went on a quest to find out all that they could about the history of Thanksgiving Day. How much can you find out in your reference books and histories? Who were the Pilgrims? When did they come to this country? Why did they come? Where did they land? What did they find? Of what did their first harvests consist? In what ways did their crops differ from similar crops at the present day?

Another thing that the young folk liked to do long ago, and that you will also enjoy, was to collect specimens of harvest crops. You might have an exhibit showing grains, grasses, garden crops, and fruit. In connection with this exhibit some of your drawings of harvest crops and your compositions about them would be interesting to your parents. You might like to have an hour or two on Wednesday afternoon with your friends and to prepare a Thanksgiving program for the occasion. Have the parents take part. The farmer who is most successful in growing corn or potatoes or fruit will tell you about his farm methods. The mothers who have learned some new way of preparing winter vegetables or canned fruits might give their recipes. With the aid of your teacher you might have a play, founded on your study of history, which will give an idea of the first Thanksgiving Day and show how the people dressed and talked and how they celebrated their holiday.

There should always be a good Thanksgiving story read or told. Be on the lookout for one. There were two stories read every year in that old schoolhouse beside the straight white road. They were in St. Nicholas magazines, one called " The Kind Turkey-man " and the other " The Saucer Pie." The teacher can recall these stories now and see the small upturned faces filled with interest. Ask your teacher to look for a good Thanksgiving story if you cannot find one at home.

Another custom that you ought to consider is to prepare a Thanksgiving basket to be sent to some one in the neighborhood who is old and alone, or ill or in need. Each pupil may make a contribution of vegetables or fruit, and the basket can be trimmed with evergreens and red-berried vines that will make it attractive.

In many country homes there are fine old steel engravings of Pilgrims and of harvest scenes that will add interest to the study of the week. Perhaps some parents interested in the school will lend such pictures, or at least one for the day on which the program is to be given. In that old schoolhouse by the bit of pine woodland the teacher hung a picture that belonged to her, and to this day it is remembered by boys and girls who became familiar with it through many school days.

Another thing that you must surely do is to learn a poem. One that children loved in the long-ago was written by Lydia Maria Child and is called "Thanksgiving Day." It is full of the spirit of the home feeling of country boys and girls. The first and last stanzas are as follows:

"Over the river and through the wood,
To grandfather's house we'll go;
The horse knows the way
To carry the sleigh
Through the white and drifted snow.

* * * * * * * * *

"Over the river and through the wood,
Now grandmother's cap I spy!
Hurrah for the fun!
Is the pudding done?
Hurrah for the pumpkin pie!"

This old poem is as good to-day as it was in the past and we hope you can all recite it or sing it, for it has been set to music — and very good music, too.

Then, last of all, let us think much of the joy of the open country at Thanksgiving time and of all the blessings of it that are ours:

The great stretches of brown field and wood.

The sound of wind and rain and the late autumn calls of birds.

The tinkling of cow bell and crowing of cock.

The odor of hay and dew-wet fields. The odor of apples.

"The nuts from brown October's wood."

The kitchen in which we help with the Thanksgiving dinner.

The fireplace about which the home folk gather for the evening and roast apples, crack nuts, and sing sweet old songs.

The quiet nights for sleep while the stars sparkle or the winds and the rains make music.

A LETTER TO GIRLS AND BOYS

Dear Girls and Boys:

HERE, it is a bright, warm morning in early September. I am out in the country sitting in the shade of a locust wood to rest and cool off after a two-mile walk along the sunny roads — such a walk as hundreds of you have taken on your way to school this morning and many other mornings. It is not always sunny and we are glad that it is not, for we like the changes of weather. Even the most familiar road or path has something new each day for the person who is in tune with the out-of-doors, because no two days are alike. There are clear, cool days and warm, hazy days. There are rainy days, snowy days, windy days, and quiet days.

One of the most important things that we should think about, if we are to love all kinds of weather, is our clothing. A person cannot enjoy a rainy day if he is dressed in his best clothes, nor can he enjoy a warm day if he is dressed too heavily, nor a cold day if he is dressed too thinly. We must dress to suit the day. This does not mean that we need very different clothes for each day, but merely that we think of the kind of day it is when we dress, and add a garment or leave off a garment, or substitute waterproof for dry weather clothing, as the case may be. I want boys and girls to be a part of the out-of-doors in all kinds of weather, and a consideration of clothing is important.

School has begun again. When you receive this leaflet it will be well toward Thanksgiving time. Read what is said about our great American holiday and try to live in the spirit of thankfulness — thankfulness for life, for health, for parents, for friends, for nature, for books, for all the things that we too often take as a matter of course, thinking we deserve them. Let it not be true of us that we do not appreciate a thing until we lose it. Let us realize all the good things that are ours while we have them.

We want you all to read everything in the leaflet carefully; read it more than once and think over what you read. See whether there is not some piece of work that you can do, whether you are a very little girl or boy or are almost grown up. There is work for all and all should work, some of the time at least. When we are very small we cannot do much, but we can do something and do it well. As we grow we can do more and more until finally we take our places as men and women in the world of workers. Take time for good, wholesome play, also. We all need to play, young and old need play, but work and play should not be combined. One thing at a time. Play is not work, nor is work play. Each has its time and place; each has its purpose in our lives. When we are young we play more than we work. When we are older we work more than we play. But we should never be too young to work and never too old to play. If either work or play is lacking we are not normal, we are not balanced, we are not living rightly. Boys and girls can think of these things, they do think of them, they like to think of them; they like to think of them because they are full of life and because they are growing toward manhood and womanhood.

One thing I must make very clear to you all, and this concerns your letters to me. I receive so many letters that it is difficult to record them unless they are plainly marked. I wish to send pictures to all those who write to me three times this year; therefore the district number and the town and the county must be very plainly written at the head of each letter, as in those printed in the leaflet. Many of you will write more than the three letters, and I know you will do so because you really want to write to me. I shall always be glad to receive any letter and will read it carefully. I hope, also, that it will be possible for me to answer personally more of your letters than it has been possible to answer in other years.

The comrades

I know you all are wondering about the picture that you see on this page. Last June I visited a rural school on Long Island. It was the last day of the school year and the teacher and pupils were having a little feast of ice cream and cake when I arrived. In a few minutes the strangeness wore off and we were all friends together. School was dismissed early, and after luncheon the five boys and the dog in the picture went for a walk to the woods with me. It was a beautiful day. We did not talk a great deal, but we found many interesting things and we felt that we belonged to the out-of-doors. We felt that we had known each other a long time. We were comrades.

This brings me to the walking trips that I told you about in the March leaflet last spring. When you read this letter, the first trip will be over and I shall have seen and talked with some of you. In the January leaflet I shall tell you all about it. Just now I am looking forward to the trip in October with a great deal of joy, and a real longing to be out in the country, in the schoolhouses, in the farm homes, on the open roads, in the woods and fields, with my young friends. Yet I am a little afraid, too — afraid that you will expect too much and be disappointed. You must think of me as an older brother, who has not yet learned very much. I love children and I love the out-of-doors. I want to bring children and the out-of-doors together because I know how much this will mean in the children's lives; so I am going out to you just to be with you, to learn your thoughts and to tell you mine. You will have much to teach me. Perhaps I may be able to teach you a little. We shall all learn together. In April I shall walk again in a different direction from that taken in October, and I hope that each year these two months will find me with some of you. So wait, and our day together will come. When it does come let us not be afraid, but let us make the most of it.

Write to me often.

Your friend,

Edward M. Tuttle

LETTERS FROM GIRLS AND BOYS

District 13; Town of Chemung; Chemung county

Chemung, New York, April 14, 1913

Dear Mr. Tuttle:

I am eleven years old. I am going to tell you one of the aims of our school, and that is neatness.

The teacher does her part by sweeping and dusting the interior of the schoolhouse. The pupils help her by cleaning their feet outside on the porch and keeping their desks clean.

In the hall we have individual drinking cups, clean wash dish, soap dish with soap, and a clean towel. We keep the rubbers and clothes picked up.

We have a stone boat, which we draw away rubbish with. In this way we clean the schoolyard. We have a lot of fun and don't realize we are working.

Some recesses and noons we pile the wood up in the woodshed in neat little tiers and we keep the coal picked up.

Yours truly,

LORENZO LEPPER

Editors' note.—We take pleasure in publishing the letter from Lorenzo. There is much more in it than the few statements that he makes. It is easy to read between the lines and to see that every one in this school worked with an end in view. The teacher did her part and the pupils did their part. All worked together and thought it fun because they put spirit into it and were able to see the good results of their efforts. Note particularly the individual drinking cups. We know more than we used to about the transmission of diseases, and we have come to feel that it is neither sanitary nor courteous to pass a dipper around and let several persons drink from it. Boys and girls, with the advice and help of their teacher, can keep the school building and the school grounds in good condition, clean, orderly, and attractive, and from time to time they may be able to add some article to the school equipment that will contribute to the convenience of all.

District 12; Town of Genoa; Cayuga county
Atwater, New York, R. F. D. 25, February 13, 1913

Dear Mr. Tuttle:

I am a little girl and I live at Five Corners. I have read your leaflets all through and I think they are very interesting. I have read the children's letters also and now I thought I would try, too. I will tell you about some dear little robins I once had.

One morning I went up to my room and saw some dry grass on my window sill. I watched every day and found it was robins building their nest; they brought some mud and then some more dry grass and threads and soon they had a fine little home.

First the mother bird laid four little blue eggs, then she sat upon them for some time. Soon the little robins were hatched, and it was so much fun to watch the old birds feed their young. They would bring a worm, divide it equally, and each time they would come the little birds would have their mouths wide open for more.

The birds all lived but one, and it fell out of the nest a few days after it was hatched and soon died. I was very sorry.

It was very interesting to watch them grow.

We removed almost everything from the room and put the windows up. The next morning when I went up, the mother bird was on the bed trying her best to coax the little ones in the room, then she would fly about in the room trying to teach the little ones; they soon learned and then flew out into the apple tree which was near the house and I did not see any more of them that year. I was very sorry to have them go as it was so lonesome without them.

I think they would have come back the next year, but I thought I would build a house for them so I put a little box outside the window and I think it scared them away. I was very sorry.

Watching and hoping for your next leaflet, I remain,

Your true friend,
ESTHER H. STEPHENSON

Editors' note.—Esther has the true spirit of the naturalist. In the first place, she noticed the dry grass on the window sill. Some others would never have seen it. Secondly, she let it alone, and watched. She had her reward and will never forget the family of robins that lived for a season in and about her room. Everywhere in the open country experiences such as this may come to those who are ready for them. In order to be ready we must learn to love all natural things and we must learn to control ourselves — to control our senses, that we may perceive; to control our minds, that we may understand what we perceive; and to control our bodies, that we may be patient to watch and not idly or carelessly disturb the life of the out-of-doors. Esther made one mistake, which she herself realizes. She tried to change natural conditions that were right in themselves. A bird house is a good thing to build and set up, but it has its place in surroundings that without it would not attract the birds. We should be guided in our attitude toward wild life by observing its own instincts.

District 8; Town of Potter; Yates county

Rushville, New York, December 10, 1912

Dear Mr. Tuttle:

I thought I would write you a letter telling you about our garden exhibit, which was held at the school grounds. At trustee meeting in the spring the taxpayers voted five dollars to be paid for prizes for vegetables and flowers. We had to do all of the work but plowing and dragging the ground. Then when it was time we put the seeds in and tended to them all summer. In the fall of 1912 we gathered our products and we all brought them to the schoolhouse in the morning so that we could get them arranged before evening, for we had invited all the people in the district to come in the evening to see the exhibit. We trimmed the schoolhouse with wild grapevines and some wild flowers. After we had trimmed the schoolhouse we got some sawhorses and put some planks on them, then we took two crates and set them on the other planks at the back side and then we put another plank over these. Next we got two sheets and put them on; then we got the vegetables and put them on the lower shelf and the flowers on the top shelf. The prizes were given in two divisions, one for the children under nine years and the other for the children over nine years of age. While we girls were doing the work in the schoolhouse the boys were out of doors freezing the ice cream for our refreshments in the evening. The last thing we did before we went home was to put up the Japanese and Jack-o'-lanterns ready to light. We went home about half past five o'clock and ate our supper and prepared to go back for we had invited our guests to come at half past seven. They began to come even before we could get back. They visited and looked at the exhibit for a while. Then Mr. Corbit, our superintendent, read off the names of those who got the prizes. After we got our prizes we went and served the refreshments. We had sandwiches, coffee, salad, ice cream, and cake. While they were eating we counted the people and found that there were eighty people that came. Every family in the district was represented. After supper we children went out of doors and played a little while. Our company stayed until about eleven o'clock and they seemed to enjoy it all very much. They liked our exhibit and many thought we deserved more prize money another year. We scholars had such a good time that we want a better one next year. I hope I can write you another letter before long.

We are studying the lessons out of the leaflets now and I enjoy them very much.

Sincerely yours,
FLORENCE FOSTER

Editors' note.—What a fine exhibit they had in Florence's school! There were only eleven children in the school last fall. We should like to have more rural schools produce something as well worth the while. See what was done. The boys and girls began the previous spring. They worked all summer taking care of their vegetables and flowers. On the day of the exhibit they worked until late in order to have everything right. The exhibit was a success because spirit and enthusiasm and hard work were back of it. Note that every family in the district was represented and that the people stayed until eleven o'clock. There was real interest taken in something worthy of interest. This is always so. We hope that there will be more and more gatherings at the schoolhouse that will bring teacher, children, and parents into a more intimate relationship. Boys and girls can bring this about if they will work together to produce the best of which they are capable. Opportunity for such gatherings may be found in exhibits such as this one, in Corn Day, in Arbor Day, in a spelling match, in an entertainment of music and recitations, in a school play, and in many other ways. We should like to hear from any school that has such a meeting.

Editors' note.— Last year Mr. Tuttle received a letter from a pupil in one of the rural schools of the State inclosing an original poem entitled "A Girl's First Room." In some way the letter was lost and cannot be found. The poem had a special interest for us and we hope that the girl who wrote it will see this notice and send us another copy.

A FEW REQUESTS

We are very anxious to know more about our rural schools in order that we may feel nearer to the daily lives of our boys and girls. One can learn much from a photograph and we hope that you and your teacher will help us by sending photographs of your school building, the inside as well as the outside, and, if possible, photographs of the pupils at work either outdoors or in the schoolroom. We should also like photographs of your school garden or home garden next spring, or of anything connected with your school or home that will bring your surroundings nearer to us. We should be interested in photographs of bird houses that you have made; of houses that you have made for your poultry; of entertainments at the school. We shall be grateful for any one or more of these photographs that you can send conveniently. Be sure that your teacher's name is written on the back of each.

A bird-house exhibit

Boys and girls, and sometimes teachers, in rural schools ask us to suggest games that can be played out of doors. If every one will help, we shall be able some day to write a leaflet on play in the country that will aid in extending knowledge of a great many good games throughout the State. For your language lesson some day perhaps your teacher will allow you to describe the games that you know how to play and that you like best, and, if she does, we hope your compositions will be sent to us. We shall file them carefully and when we prepare a leaflet on play we shall publish some of the best, and in this way other boys and girls will receive the benefit of what you have written.

Some day we hope to publish a list of things that the teachers and children of some rural schools have bought to add to the attractiveness and comfort of the school building or grounds. We already have a good beginning for such a list, but we should be glad to hear of anything that you have actually obtained for your school. Perhaps it will be suggestive to other schools.

Winter sport

Cornell Rural School Leaflet

FOR BOYS AND GIRLS

Published by the Department of Rural Education, New York State College of Agriculture at Cornell University. W. A. Stocking, jr., Acting Director. Entered as second-class matter, Ithaca, New York

ALICE G. McCLOSKEY and EDWARD M. TUTTLE, Editors

ARTHUR D. DEAN, C. EDWARD JONES, G. F. WARREN, and C. H. TUCK, Advisers

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“ Ah, may I be as cheerful
As yonder winter birds,
Through ills and petty crosses,
With no repining words;
So, teaching me this lesson,
Away, away they go,
And leave their tiny footprints
In stars upon the snow.”

GEORGE COOPER

A LETTER TO GIRLS AND BOYS

Dear Girls and Boys:

It is time to write another letter and there is much to say. Autumn and harvest, Corn Day, Thanksgiving, and Christmas are past. Ahead are lengthening days; robin, bluebird, and thrush; snowdrop and anemone; babbling brooks and green pastures. Spring is ahead, and we begin to look for the first signs. Yet, even in our delight at thought of growing things, we rejoice in a last cold spell that keeps the skating good for a few days longer; we shout in the morning to see a fall of snow that gives us sledding for an hour. Hoping for spring we still are loyal to winter, for we love each season so much that it is hard to part with it.

Some long winter evening, after you receive this leaflet, is just the right time to make plans ahead. It is warm and cozy before the fire, and you can think great thoughts and dream bright dreams. Shall I tell you some things that I have been thinking about for you?

As you know, last October I took a walk. Starting from the city of Cortland, I went eastward through the country. I tramped for three weeks and stopped at such schools as lay on my road. In each school I was welcomed; in each school we talked together for a while about outdoor life, and usually we took a trip to brook or wood or pasture in order to see what we could learn that would be new and interesting. I enjoyed the days spent in this way and hope that in those schools at which I stopped the times that we had together are still remembered.

During my visits my own boyhood came back to me, and I could see wherein I might have done better. All boys and girls are much alike, and sometimes they are careless and thoughtless of life of all kinds. If we are going to know and love the great outdoor world, we must be able, first of all, to leave natural things unmolested and to enjoy them as they are. One day a little snake ran across the road, and a boy struck it with his heel and broke its back. He did not kill the snake — it would have been better had he done so — but he left it to drag off as best it could and to die slowly somewhere because it could not search for food. The snake was harmless; it was more than harmless — it was useful. We should think before we strike. On a rock, under the shadow of a tree, a little girl found a clump of moss, cool and green and fragile. With a cry of joy she tore the moss from its bed and held it up for us to see. She did not think, until too late, that it would wither and die, or that she had spoiled the mossy bank and the next person to come that way would find no spot of beautiful, cool, green color. We should think before we destroy. Let us have reverence for each fern, each flower and tree, each bird, insect, and animal. Each should be allowed to live its life undisturbed provided it does no injury. Our joy will come from watching, without touching, lest we harm.

Sometimes I wonder whether, when we travel through the country, we truly see and hear and smell. Are our senses keen and trained? One day I took a walk with some school children. We went along a meadow path and passed a golden buttercup. Afterward I asked, "Who saw a flower blooming?" No one had seen it. All had eyes, but had not used them. On another day, two children and I were walking side by side along a country road; we halted for a moment so as to listen to the sounds about us. A running brook, a cricket, an unseen wagon on a distant road, and, far away, the lowing of a cow were heard. The children had heard the stream, but nothing more that they remembered; yet, when we talked about it, they recalled the other sounds, which they had heard without being aware of them. When we listen, let us truly listen. The world of Nature is full of beautiful sights, pleasant sounds, and sweet odors for him who seeks them.

In this leaflet you will find many suggestions for work during the coming months. Let me ask you to think of their importance. I hope that every girl and every boy who reads the letters in the leaflet will plan, carry out, and finish some piece of work this year — work that will be of value to others. We have suggested the home garden, as we always do. There is nothing that will be of greater benefit to those at home and of greater happiness to yourself than to plant and care for a good vegetable garden. Read the article on page 1181. Or, if you do not have a garden, take charge of the flock of hens and make them pay. Read about this on page 1183. Especially read, think over, and carry out the suggestions in the articles on pages 1189 and 1191. To set the table or to help wash the dishes is a little thing to do each day; but you will find, if you do it regularly, how much your mother will appreciate it. Perhaps it will give her more time to be with you. I am sure you love those hours when you listen to her reading or singing, or when she joins in a merry game. Have you ever stopped to think that these good times will come oftener if you help your mother with the housework? Boys, as well as girls, should learn these things. I have found that often it is good to know how to make a bed, set a table, wash and dry the dishes, or use a broom. In the same way girls find it useful at times to know how to milk a cow, or how to clean, harness, and drive a horse. Usually men do the outdoor work and women the indoor work; but each should understand the other's task, not only in order to take it up in case of need, but also in order that each may appreciate what the other has to do daily.

The school yard is in the grip of winter now. The soil is frozen and covered with ice and snow. Soon, however, the warm sun of spring will change all this. When the soil is thawing, study your grounds. Does the water run off out of the way, or does it stand in puddles where it is not wanted? It may be that you can help to drain the yard by a shallow ditch at one side. Try to keep off the yard during those few days when the soil has thawed and softened and before it has had time to settle. It is easy then to tear the surface and make it rough. Perhaps a little grass seed could be sown on the bare places while they are soft. After the soil is firm and before the leaves have started, take a look at the trees and shrubs in the school yard. Do they need pruning? Is there a wild fruit tree that can be grafted to a good variety? Do you think another tree, or a shrub or two about the building, would make the yard more attractive? There is always something that can be done. Plan to do at least one thing for the school grounds. In the March leaflet we shall send some helps on planting, pruning, and grafting.

This is a long letter, but you know I said at the beginning that there was much to say. I hope you will be interested in it all. I hope each one of you will determine to make this new year the best that you have ever lived — the best because you do something for others and, in the doing, make something of yourself. We all want friends, and they will come to us if we are clean and honest, unselfish and patient, brave and cheerful.

Write to

Your friend,

Edward M. Tuttle

LETTERS FROM GIRLS AND BOYS

District 1; Town of Augusta; Oneida county

Oriskany Falls, New York, February 27, 1913

Dear Mr. Tuttle:

I am very much interested in agriculture. My teacher's name is Miss G. L. Stoddart. This is her second year with us. We like her very much. She has worked very hard with us so that we could pass regents examinations. After receiving the leaflet you sent her for us last year, our interest in agriculture grew. I attend the Oriskany Falls school where I am in the eighth grade. My home is in the village.

In March our room had a poultry show. We had it in the schoolroom. Most of the birds were taken to the schoolhouse the night before the exhibition. We had many different types of fowls. Among them was a peacock. On the day of the exhibition we tried to have regular school in the morning. It was rather a noisy schoolroom with hens cackling and roosters crowing. In the afternoon guests were invited. The pupils from the other rooms came and saw the fowls. Some of the pupils recited and some others read selections from the Rural School Leaflet. Some wrote and read articles on the different types of hens. We enjoyed the show very much and thank the New York State College of Agriculture for sending us the leaflets which made us think of having an exhibit. I wish that you could find a place, perhaps, in the leaflets to tell other boys and girls about our poultry show.

Your friend and nature lover,

HELEN A. BIGELOW

Editors' note.— Here we have a new kind of school exhibit. Helen goes to a graded school, but any one-room rural school can have a poultry show that will be just as successful. We hope that many schools will follow out this suggestion sometime before the end of the school year. How interesting it must have been to watch the poultry in the schoolroom and to listen to the cheerful cackle, and how much must have been learned about the habits of the different breeds! It is a fine thing to have a show of this kind, which brings natural life into the schoolroom for a day, and such an experience is well worth much effort. Helen does not tell how the birds were cared for; a good box with wire netting over the front and some litter on the floor would do very well.

District 2; Town of Pomfret; Chautauqua county

Fredonia, New York, November 8, 1913

Dear Mr. Tuttle:

I am a school girl fourteen years old and am in the fifth grade. I live on a farm of seventy acres. I have three sisters and one brother.

I go to district school No. 2 in the town of Pomfret, Chautauqua county. My teacher's name is Miss Hilton. We all like her very much. I have to walk nearly a mile and a half to school. When we go to school we look at all the different kinds of birds, trees, and plants; when we get in school we tell Miss Hilton and the other children the things we saw. We have a bird calendar in school. Each child is to see who can get the most birds down; we have thirty-three different kinds of birds' names down already and expect to get some more. It is lots of fun doing it. We also have a tree calendar and we are going to have a plant calendar, also. We have a large piece of cardboard and have pasted thirty different kinds of leaves from trees on it. The pupils all help to find different kinds of leaves. Miss Hilton sent for a book of different kinds of trees called "Our Native Trees." When we find a tree that we do not know we look it up. In our nature study we have studied all the birds except the junco and guinea fowl. We are now studying the trees. We had the elm for special study this year. When we studied it we went to the woods and got a branch so we could study the bark, leaves, and wood. We also got branches of the oak, maple, sumac, and tulip tree and studied them the same way.

"*We all planted a flower garden*"

I have learned several different kinds of trees that I did not know the names of before. I know and recognize thirty-three trees and I am still learning more. Miss Hilton took us out for two nature-study walks. Once we went up to the Cassadaga Lakes and after that we went to the waterworks. When we went to the Cassadaga Lakes we were going to see who could see the first bird. We had to be very still because we would frighten the birds away so we walked along very quietly. We put all the names of the birds, trees, and plants that we saw and recognized, on a piece of paper. Then we went to the lake and sat down and watched for birds. We saw the lake kingfishers, hell-divers, and wild ducks, and we saw many other birds on our way.

Our school is near the waterworks; one Thursday we went about three o'clock in the afternoon after we had all our studies. I like nature study, and study the different kinds of birds, trees, and plants and study the different ways the birds build their nests, and their habits. Miss Hilton is talking about taking us to Niagara Falls.

Last term we all planted a flower garden in the school yard, and when we were spading up our garden our teacher took our picture. I am sending one to you. My flowers blossomed all summer and they still have blossoms on. I also have a garden at home and I have several house plants. This is my first letter. I am going to write two more so I can get a gift picture.

Yours truly,
HULDA SCHESKEY

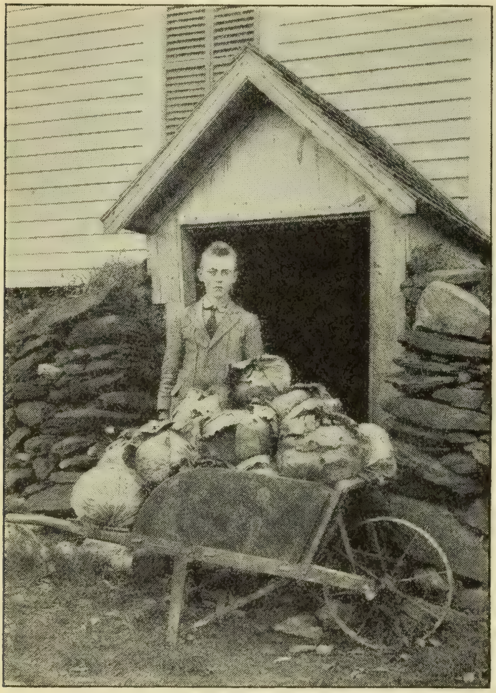
Editors' note.— Hulda and her schoolmates have had interesting times, as you will see from her letter. We are glad that sometimes pupils are taken out of doors to study. Any school can keep records or calendars of natural objects. The fun and the interest grow when the lists have all the common forms on them and the search for new specimens is more difficult. A most fascinating study is that of the migrating birds and the keeping of a bird calendar. Doctor Bailey said a short time ago that the birds are the earth's great travelers. Up and down the world they go, thousands and thousands of miles in a year. Let us welcome them back this spring and become familiar with the time of their arrival. On page 260 there is a migration table that will help you.

District 3; Town of Amenia; Dutchess county
Wassaic, New York, May 23, 1913

Dear Mr. Tuttle:

I am writing to thank you for the picture of the goldfinch you sent me and to tell you about my garden. Our school has a small garden in which I have planted several rows of seed which are just coming up. We wanted to plant them on Arbor Day, but as we could not get the seed in time, we had to wait till a week after before we could plant them.

I will now tell you about my garden at home. It slopes toward the east; I would like to have it slope toward the south but, as there is not any land that slopes toward the south or west near the house, I could not have it so. The soil is loam and quite rich. I had it well covered with manure. As it covered one eighth of an acre I had it plowed and well harrowed. I then drew off the sod and stone. Then I got a chalk line seventy-five feet long, which just reached across the garden north and south. I got two sticks each three feet long, and sharpened at one end. I tied the ends of the chalk line to the sticks. I then measured three feet out from the fence and stuck the sticks in. I then took a hoe and made a row across the garden directly underneath the chalk line; in this way I made all the rows. In the northeast corner I put four hills of summer squashes, south of them I put three short rows of beets and two of swiss chard, south of them I put in six hills of Hubbard squash, then fifty-five hills of pole beans, part butter and part long white ones whose name I cannot think of just now, and beyond the beans there are six hills of delicious squash. I then skipped a line so the squash will have plenty of room in which to run. Then to the west I put some cucumbers which occupy four half rows; on the other end of the four half rows I put potatoes. Then, there is a half row of lettuce and a half row of radishes, a row of beets, a row of onions, three rows of bush beans, a half row of carrots, a half row of salsify, a row of parsnips, eighteen hills of muskmelon, some more cucumbers, a space for tomatoes and cabbage, and then six rows of peas. This rain is making them grow very fast. Father says he will get me a seeder and hand cultivator next year.



Some of Stanley's garden produce

I should like very much to have you come to our school. I will write to you next summer and tell you how my garden is getting along.

Your friend,

STANLEY BENHAM

District 3; Town of Amenia;
Dutchess county
Wassaic, New York,
September 19, 1913

Dear Mr. Tuttle:

As you requested I am writing you to tell you how my garden has turned out.

There has been a severe drought here this summer, and although I did not carry much water for the garden, it grew fairly well. I had enough summer squashes to supply a family of seven, besides giving some to the neighbors. The later squashes are also bearing well. I have not picked my pole butter beans yet; have the white pole beans; they yielded about one bushel. Have dug half of my potatoes; obtained a bushel. My cucumbers have done well; some vines are bearing yet. Had all the lettuce and radishes our family wanted besides giving some to the neighbors. Have not pulled my beets and carrots yet; the tops have grown well and I hope the bottoms have, too. My bush beans grew fine; our family had all the string beans we wanted and gave several messes away. I picked the rest after they became dry and got two bushels. Onions, parsnips, and salsify have grown well. The dry weather hurt my peas some, but we had all we wanted. The tomatoes are bearing well. Have had a fine crop of muskmelons; had several weighing over seven pounds. I gave away some, carried several to school; the teacher and scholars had a fine time eating them; I also sold several. My cabbage has grown fine. I have one hundred and twenty-two plants; have had some trouble with the cabbage louse and cabbage worm.

I spent a part of each day working in the garden, and every two or three days I inspected the cabbages and picked off the green worms. I put pyrox on my potatoes, beans, and squashes. I did not have much trouble with cutworms; found one, but he did not live long. I had expected to set out some strawberry plants, but as it was so dry I did not. I am going to have a garden in the same place next year, and hope I may have as good luck.

Your friend,
STANLEY BENHAM

Editors' note.— When we received Stanley's first letter last spring we saw at once that he was really doing something and that he would have good results if he persevered. So we wrote and told him that we wanted to hear about the garden at the end of the summer, and that is the reason for the second letter. Stanley is only eleven years old, but he helped in a very real way to produce food for family and friends. We hope you will notice some things particularly: (1) Stanley knew the kind of location that would be best for a garden, but he was not discouraged because he could not find it on his own farm. He made the best of what he had. (2) He must have planned the garden carefully, because when he planted it he left room for the spreading plants to grow and space for later planting of tomatoes and cabbage. (3) He grew a variety of vegetables. (4) He did not lose courage because this was a very hard, dry season, but worked in the garden "*a part of each day.*" Stanley is not a quitter. (5) He is to have his reward in a tool that will help him another year. (6) He is going to have a garden next year.

Here is a fine example of good work. What eleven-year-old Stanley did, any boy or girl of that age or older can do. We hope to hear of very many successful gardens next summer.

THE LETTER BOX

Every day in your school some boy or girl makes a discovery on the farm or along the wayside, which we should like to hear about. We should also like to know of all the new plans for next spring. For this reason we want you to make a letter box for the schoolroom, and to put into it letters for Mr. Tuttle whenever you have learned something new or when you have started an experiment of any kind. When the box is filled, perhaps your teacher will mail the contents to us. Remember that every communication will be read even if each letter is not answered personally. Always be sure to give your district number and township.

What will you write about? Anything that is interesting to you will be of interest to us. Some of the subjects will perhaps be as follows:

1. A branch of evergreen of which you want to learn the name or which your teacher has named for you.
2. An account of the largest number of egg clusters of tent-caterpillars brought into the school, and what was done with them.
3. A description of a hornet's nest that Jim found on his farm, and of how the teacher opened it and showed you the way in which the insect home was made.
4. Something about the collection of birds' nests that have been brought to school by Mary and Sue and Peter.
5. All about the afternoon when the teacher let you run out into the snowstorm for a minute so that you could see the snowflakes on your coat sleeves. If you saw them through the teacher's magnifying glass, you will tell us what they looked like.
6. At what hour the sun set on January 24.

7. On how many days in the month of February the thermometer registered below zero.

8. An account of your visit to Philip's farm in order to see the poultry house that he and his father are building for Philip's poultry next spring.

9. What your garden plans are for next year.

10. How seed-testing is done on your farm.

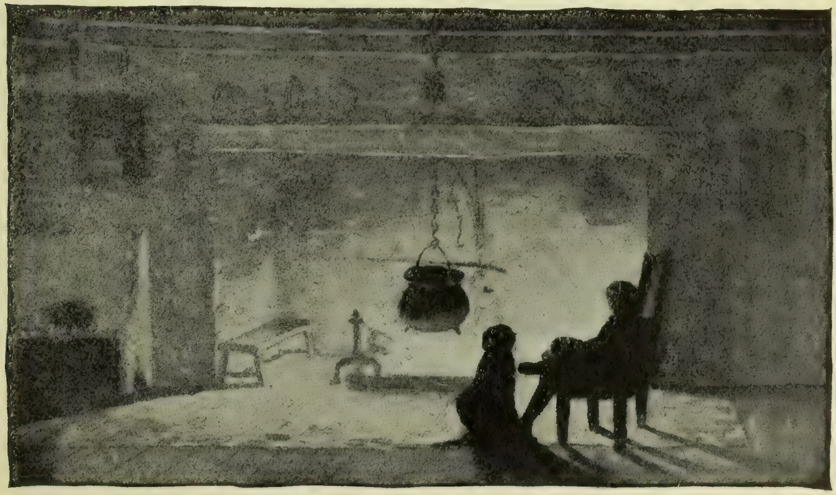
A FEW QUESTIONS

ALICE G. MCCLOSKEY

How many boys and girls know what was meant in the old days by a chimney corner? Perhaps your grandmother can tell you about one, and then you will wish that you and I might sit in a chimney corner and talk over some things worth while. We might discuss the wonder of the sunset that we watched at tea time, the music of the little poplar tree by the window, and the mystery of the stars. We might talk about your home life and all the happy hours that are yours every day, or perhaps we might sing some old song there in the cozy nook while we watched the firelight.

Now chimney corners are rare in these days, and, indeed, fireplaces are too; but if I were with you we could find some quiet place in which to have a little talk all by ourselves, and I know some things that I should like to ask you. I cannot be with you, however, and so I shall have to write the questions:

First, where is the most attractive schoolroom that you have ever seen and why did you like it? Were the walls a quiet color, a soft gray or a



Watching the firelight

tan? Was everything very clean and neat in the schoolroom? Was the teacher's desk neat and well dusted, with a few well-bound books on it? Was there a good bookcase? Was the organ dusted? Had the floor been well swept? Were the windows clean? Had some one removed all finger marks from the woodwork? Was there at least one attractive picture on the wall?

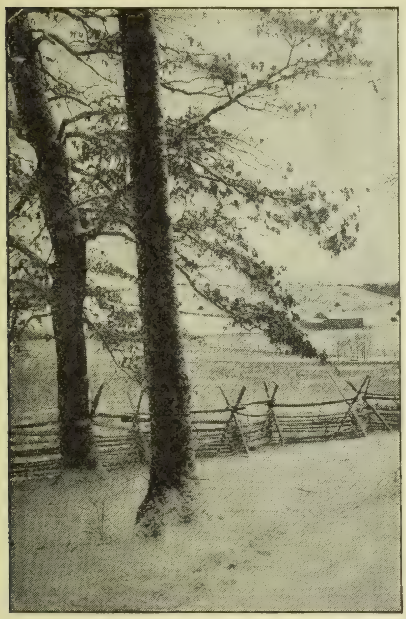
I have seen schoolrooms such as this and know one very well that has been cared for by the pupils. Even the white curtains at the windows were made and laundered by the girls. It is always pleasant to enter this room. The air is good, because occasionally the children are allowed to run out of doors for a few minutes while the windows are opened in order to let in the sweet, fresh air. No one can be happy in a dirty and unattractive room, and I want you to help your teacher to make your schoolroom the very prettiest and the most wholesome in the country round. Will you think about this?

I have another question: Where have you seen the most attractive school yard? There are not many school yards that we care to look at; and yet, if something were done each year to improve the school grounds, they might give much joy to teacher and pupils and every passing traveler. In the September leaflet there is an article that the teacher may like to talk over with you. It will teach you how to plant your school grounds. Be ready to do something toward this in the spring.

There is a third question: What is the most satisfactory garden that you have ever seen? There is nothing more interesting than a garden, and every boy and girl in the world should have an opportunity to make one and to grow both vegetables and flowers in it. One of the finest gardens that I have ever seen was planted and cared for by boys and girls not over twelve years of age. It was in Germany, in a most wonderful valley from which one could look up at the great snow-capped peaks of the Alps Mountains. The garden was free from weeds, and the plants looked so strong and thrifty that I knew the young folk had been very painstaking in caring for them. They told me that the garden belonged to the schoolmaster and that it was a part of their school work to take care of it for him. It is very satisfactory to have a garden that will be of use to some one. Think this over carefully.

When you write to Mr. Tuttle tell him your viewpoint on all the questions that we have asked. We shall be interested in everything that each one of you has to tell us, from the youngest to the oldest. We shall be particularly interested if you have helped to have a more attractive schoolroom; if you have helped to make curtains for the windows; if you have planned to do some planting this spring on the school grounds; if you have decided to have a garden at home that will provide food worth while for family use.

WINTER THOUGHTS ABOUT THE HOME GARDEN



Each year at this time the subject of the home garden comes strongly to mind. Every farm should have a garden. Every village home with a little land around it should have a garden. "A garden is a lovesome spot"— lovesome because it brings the gardener close to nature, close to growing things, close to soil and wind and rain. Moreover, a successful garden is a triumph of care, perseverance, hard work, real effort. It builds character. Again, a garden represents dollars and cents. The great variety of food obtainable from a vegetable garden is worth two to three hundred dollars a year to a family. It therefore provides income.

Knowing these things, consider them with regard to your own homes. Did you have a garden last year? Was it well kept? Did it provide food for the table in good quantity and variety? If so, decide to have one as good, or better, this year. If not, can you make one? Here you are, boys and girls, ten, eleven, twelve, years old, or more. Your fathers and mothers are busy all day and every day. They either have no time for a garden, or, at best, can give but little attention to it. Can you help? Will you help? Are you willing to take some of your time this spring and summer in order to provide food for your table? Good! Now, where and how shall you begin?

The first thing for you to do is to take a look around the place for the best location for your garden. Your father will help you to decide, because he knows where the soil is richest and best, where the snow melts first in the spring, where the earth grows warm and mellow in time for an early start. It is important that the garden spot be protected from poultry, cattle, and other farm animals. The piece of ground need not be very large; it is remarkable how much can be grown in a small space if the planting is properly planned. Each one of you knows his or her strength. Do not attempt less work than you can do, for that indicates laziness. Do not attempt too much, for that becomes discouraging and exhausting. Undertake an amount sufficient to keep you active and busy if you do it well.

Now you know where to have the garden, and you have its size. Go indoors by the fire and quietly make your plans as to what you will grow, where you will obtain seeds, how much seed you will buy, and other matters, but do not buy your seeds nor make any plans that cannot be changed, until you receive the March leaflet. It is always well to make plans of your own and then improve them by taking suggestions and advice from persons of experience.

In deciding what to grow you should consider a good variety of all the common vegetables. Here is a list:

Beans, Lima
Beans, wax
Beets
Cabbage, early
Cabbage, late
Carrots
Cucumbers
Lettuce
Muskmelons
Onions
Parsnips
Peas
Pumpkins
Radishes
Squash, Hubbard
Squash, summer
Sweet corn
Tomatoes
Turnips, early
Turnips, late
Watermelon

If potatoes are not grown elsewhere on the farm, they should be included in the garden list. Some of the vegetables should be planted in a succession; that is, they should be planted in two or more places with about two or three weeks between each planting. In planning the garden, space should be allowed for the later planting. Vegetables that may be planted in succession are beans, cucumbers, lettuce, peas, radishes, and sweet corn.

Have in mind, then, your piece of ground and what you are to plant; make a plan on paper showing where each vegetable is to grow, remembering:

1. That the taller plants should be planted north of the shorter ones in order that all may have sunlight. For this reason the rows should run east and west if possible.

2. That some plants take up more room than others. Such vines as cucumber, squash, pumpkin, and the melons need plenty of space.

3. That some of the vegetables are not planted until others are through bearing. Such vegetables are late cabbage and late turnips.

4. That there should be a succession of some vegetables.

5. That there should be more of those vegetables that keep well during the winter than of those that bear only for a short time and then perish.

Among the former are potatoes, beets, carrots, onions, parsnips, late cabbage, and winter squash. Among the latter are radishes, lettuce, tomatoes, sweet corn, peas, cucumbers, and melons. Some vegetables, such as snap and lima beans, can be used either green in summer or dry and shelled in winter.

And so, in these cold and stormy days, you can have garden thoughts and make garden plans. You can study new seed catalogues which the seedsman will send to your teacher if she will make request for them; and a person can obtain much information from a seed catalogue. You can make up your mind at once never to have it said in the future that there are no good, fresh vegetables grown on your farm for the table and for canning and pickling for next winter. We want every live boy and girl to take the responsibility of having a good kitchen garden. The March leaflet will give further helps for garden work.

HOME POULTRY

Edward M. Tuttle

I remember that one summer, when I was about eleven years old, I decided to take care of the hens on our home farm. There were about forty of them — Barred Plymouth Rocks — and I think they had not laid an egg for months. No one paid any attention to them except the hired man, and he was too busy to do more than throw them a little corn once in a while or to carry in a pail of water when he thought of it.

One day the idea came to me suddenly to see whether those hens knew how to lay — to discover whether I could care for them so faithfully and so well that they would reward me with eggs. So I began by cleaning the henhouse; I carried out the droppings, raked the dirt floor, covered it with fresh litter, and made new nests of clean, sweet hay. On the same day I began a new system of feeding the hens. Instead of a diet of corn alone, I mixed with the corn some wheat and buckwheat that I found in the barn. Besides the grain I gave them a warm mash in the morning consisting of bran, corn meal, middlings, and table scraps. In one corner of the poultry house I found half a barrel of oyster shells and the same amount of grit, both of which I made use of and kept constantly before the hens. A most important care was to provide drinking water and plenty of it. My hens never went thirsty. Sometimes I took a spade into the yard and dug up earth in which they might scratch. There was plenty of green grass in the yard.

The feeding system was carefully carried out and never interrupted, for I knew that I must be faithful to the hens if I were to expect results. The flock began to look better, to sing cheerfully in the morning, to scratch eagerly for food, and, best of all, after two or three weeks, to lay eggs. I had made an egg-record sheet and was ready to keep count of every egg. For some time there was only one egg a day, then two, then four, and finally in the middle of the summer came a day when my flock of forty laid twenty-five eggs. I was a proud boy on that day. During this time it was necessary to buy fewer and fewer eggs for the family, until my flock supplied all that we needed.

The home flock

What had been accomplished? (1) I had stopped a useless waste of food for hens that did not pay. (2) I had made the hens contented and useful. (3) Fresh eggs were supplied to the family. (4) I had made myself happy in the success of my plan.

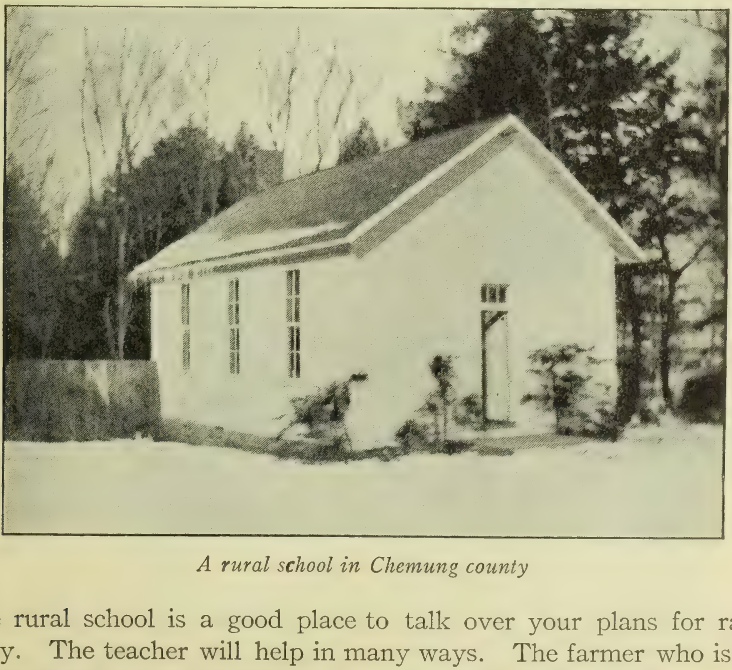
This experience is one that many boys and girls in the country can duplicate. On almost every farm there are hens. Perhaps they are well cared for. Even so, would not your father and your mother be willing to give you this piece of work if they could be sure it would be well done? Or perhaps the hens are not paying, as was the case on our farm. What should you do? Decide to make your hens pay. Do not try to do impossible things. Take what is at hand and make the best use of it. Keep the henhouse clean and dry; feed as great a variety of wholesome food as can be found on the farm; provide plenty of water, grit, and lime in the form of cracked oyster shell, limestone, or the like; be faithful and regular in caring for the flock; study the hens and learn what they like best. Any boy or girl who does work of this kind finds pleasure, pride, and happiness in doing it because it is worth while. It is production of food to eat. It helps the world along.

A good time to begin taking care of hens and to raise some little chickens is in the spring. Hens usually lay best the first and second years, and it is always well to add a few early-hatched pullets to the flock each year.

Suppose there are fifty hens on the farm and you begin taking care of them on April 1. Soon afterward set five or six hens on thirteen to fifteen eggs apiece. The hens need not all be set at once; it will depend somewhat on where you have to obtain the eggs for setting. Your father or mother will help advise you about this. After the chicks hatch out, tend them faithfully and keep them well and growing strongly. After a couple of months the young roosters will be large enough to be killed and will be very welcome on the table. The pullets will continue to grow and should begin to lay in October or November.

In the meantime the old hens have been well cared for and have produced eggs almost up to the time when the pullets begin to lay. It is a very interesting study for a boy or a girl to watch a flock of hens and to raise chickens at the proper times so that the pullets will begin to lay when the older hens stop laying. With a little observation and thought and careful work each day, you can have a flock of hens that will produce enough eggs for family use the year round.

Hens are pleasant companions, and if you are kind and gentle with them they will soon learn to know you and will come at a call, eat out of your hand, fly up on your shoulder, and do all manner of things that will make you feel well repaid for the care that you give them.



A rural school in Chemung county

The rural school is a good place to talk over your plans for raising poultry. The teacher will help in many ways. The farmer who is most successful with poultry might give a talk at the school sometime.

THE BIRDS

Every year we study the table that announces the coming of the birds in order to see when we may expect some of our favorites; and we plan new ways in which to welcome them and try to find out how we can coax them to be near neighbors. For many years we have made bird houses, and a few of us have been rewarded by having a family of birds reared in sight of our upstairs windows; but in many cases there has been disappointment, and an empty bird house has made us feel the failure of our effort.

Ready for guests.
Is the location good?

Let us persevere and be willing to wait for results, in our attempt to invite bird neighbors. There are a few things to be remembered in our attempts, and if we are patient we are sure to be successful at last. We must always have in mind some of the essentials in encouraging birds to build their nests near us:

1. A bird house should resemble the natural places that birds choose for their nests.

2. Many birds avoid new wood and new paint. The bird house should be weathered.

3. Birds often like gardens, and places that seem filled with outdoor fragrances. The greatest of all English poets, William Shakespeare, speaks of the choice of a bird haunt, as follows:

> "*This guest of summer,*
> *The temple-haunting martlet, does approve,*
> *By his loved mansionry, that the heaven's breath*
> *Smells wooingly here: no jutty, frieze,*
> *Buttress, nor coign of vantage, but this bird*
> *Hath made his pendant bed and procreant cradle;*
> *Where they most breed and haunt, I have observed*
> *The air is delicate.*"*

4. The birds have many enemies and will not build nests where cats and other animals will molest them.

5. A drinking fountain is attractive to birds. Plan to have one in your garden.

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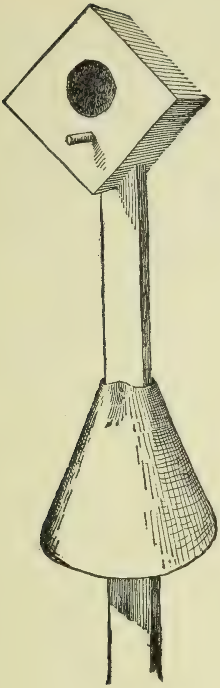
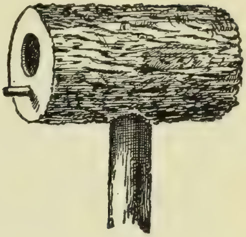
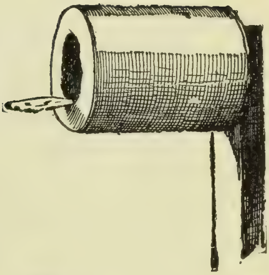
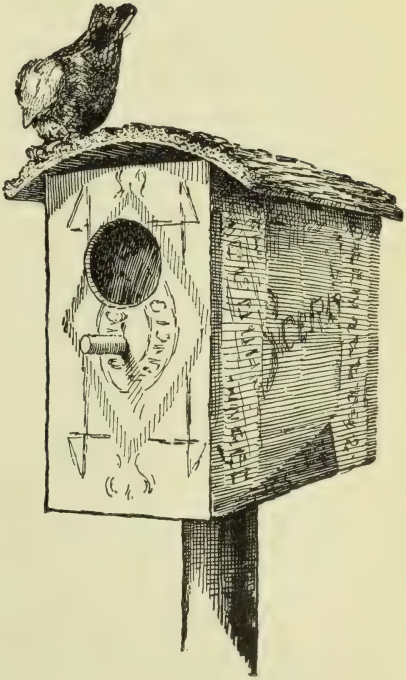
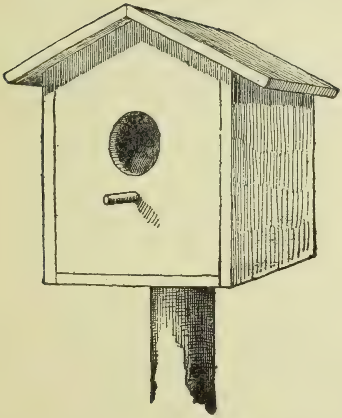
*Macbeth, Act I, Scene 6.











6. Birds that will build in houses are wrens, bluebirds, tree swallows, martins, doves, pigeons, and sometimes chickadees. Birds will not make a nest in a house in which the doorway is too large. It should be made just large enough for the birds to enter, so that it will not be easy for enemies to get in and destroy the young. For the wren and the chickadee the opening should be an inch, and for the other birds it should be about one and one half inch. Only one opening should be provided for each house. A perch should be placed just below the door. Martins and tree swallows build their nests about twenty-five feet above the ground; other birds usually prefer that their home be less than twelve feet above the ground.

LIST OF BIRDS COMPRISING THE SPRING MIGRATION*

(Until April 30 — Approximately)

Date of arrival	
February 15 to March 10	Purple grackle
	Rusty grackle
	Red-winged blackbird
	Robin
	Bluebird
March 10 to 20	Woodcock
	Phœbe
	Meadow lark
	Cowbird
	Fox sparrow
March 20 to 31	Wilson's snipe
	Kingfisher
	Mourning dove
	Swamp sparrow
	Field sparrow
April 1 to 10	Great blue heron
	Purple finch
	Vesper sparrow
	Savanna sparrow
	Chipping sparrow
	Tree swallow
	Myrtle warbler
	American pipit
	Hermit thrush
April 10 to 20	Yellow-bellied woodpecker
	Barn swallow
	Yellow palm warbler
	Pine warbler
	Louisiana water thrush
	Ruby-crowned kinglet
April 20 to 30	Green heron
	Spotted sandpiper
	Whippoorwill
	Chimney swift
	Least flycatcher
	Purple Martin
	* * * * *
	Black-and-white warbler
	* * * * *
	Ovenbird
	House wren
	Brown thrasher
	Catbird
	Wood thrush

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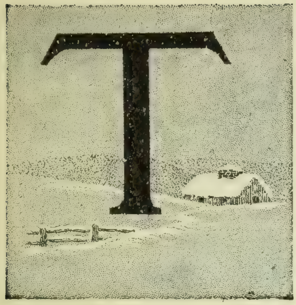
*Chapman. "Handbook of Birds of Eastern North America."

THE HOME

ALICE G. McCLOSKEY



THE word "home" is loved by every one in the whole world; old folks and little children, and, I believe, even the gray horse and the shepherd dog, love it. It is full of meaning and awakens in us many pictures that during all our lives we want to recall: mother and father; the baby sister in the high chair playing with a spoon; the little room upstairs with the sloping ceiling; the song of crickets on quiet summer nights; the first snowfall; the winter winds; Thanksgiving Day; the dawn of Christmas morning.

Perhaps I am wrong, but it has always seemed to me that the children who have had the most joy in the home are those who have helped every day in the simple home duties — carrying the wood, washing the dishes, setting the table, and doing all the other work that young folk can do. Boys and girls with the right spirit like to be busy some of the time, and they take pride in doing things well. Doubtless they will be glad to know how to improve their ways of working, and so from time to time we shall make suggestions that may help.

In this leaflet you will find lessons on washing the dishes and setting the table. Both pieces of work are very important, because no one wants to eat from dishes that are not clean and every one likes to see a table well set, with each piece of china and glass and silver in its proper place. Your mother cannot always take the time to do this, but boys and girls can add much to the pleasure of the daily life of the home by using care in setting the table, and by washing the dishes so well that every one will enjoy looking at them and using them.

Read the following lessons and some time tell us how well you have been able to follow the directions given in them. I shall enjoy picturing you at the simple home tasks, the boys as well as the girls.

WASHING DISHES

CLARA W. BROWNING

Dish-washing is a simple art, yet few persons know how to do it well. The girl or the boy who can wash dishes well has an accomplishment worth while.

When you hear persons grumble about dish-washing, you may be very sure that it is because their manner of doing it is wrong. Their work is cluttered, their dishwater is cold and greasy; the dishes are therefore hard to dry, and when dry they look cloudy instead of bright. There is, in fact, nothing attractive about the wrong way of dish-washing; it is tiresome and very unpleasant.

But dish-washing well done! Like any expert work, it is delightful. It means work carefully planned: order, no confusion, hot soapsuds, hot rinsing water, sweet, clean dishes that dry easily and look bright. A neat cupboard, with rows of dishes well washed, is in itself a reward for dish-washing well done. What a sense of satisfaction comes in bringing order out of disorder and in making things clean! How important it is that dishes should be very clean, for from them we take food into our bodies. Unless dishes are washed in hot soapy water and rinsed in very hot water they will not be safely clean, even though they may look so. The hot water is necessary to remove grease and to kill germs that may be on the dishes.

The following rules for dish-washing are very simple. If you carry them out you will find the entire task made easier and much more pleasant.

1. System saves time. Plan your work from the beginning. Arrange at once for hot water.
2. Put away all food.
3. Have a waste pan or pail, lined with newspaper, into which all refuse from the plates may be scraped. Use paper for removing grease. Rinse egg from dishes with cold water, since hot water cooks it and causes it to adhere to the dishes.
4. Pile similar dishes together.
5. Have a pan of hot soapy water for washing dishes; a pan of hot water for rinsing them; and a pan or a place of some kind for draining them. If rinsed in boiling water the dishes may be left to dry without wiping.
6. Use a clean dishcloth — not a rag. Have a supply of clean, dry towels.
7. Wash the glassware first. It may be rinsed in slightly soapy water in order to obtain a brilliant polish. Then wash the cups and the saucers and all of the cleanest dishes; then the silver. Next wash the plates and the remaining dishes.
8. If necessary, change the water frequently.
9. Do not allow too many dishes to pile up before wiping them. They are likely to be broken or chipped.
10. Put dishes away.
11. With a clean supply of water wash the cooking utensils after having removed from them as much food and grease as can be scraped or wiped off. Soft paper is good for wiping off grease and may be burned at once.

12. Dry the kettles and put them away.
13. Empty the garbage, scald the pail, rinse it, and dry it with old newspaper. If newspaper lining is used, the pail is easier to clean. It should always be left sweet and clean.
14. Empty the dishwater, and clean the dish pans, table, and sink.
15. Wash the dishcloth and the dish towels thoroughly in clean water, spread them out, and hang them where they will get plenty of air. If they are left rolled up or in a close place, they will smell sour or foul.
16. Wipe the stove with paper or with a cloth kept for that purpose. Brush the floor. You can now view your domain with pride and satisfaction.

SETTING THE TABLE AND SERVING FOOD

CLARA W. BROWNING AND BERTHA BETTS

If boys and girls want to be of real assistance at home, every mealtime will give opportunity. You all know how pleasant it is to sit down at a well-set table and to eat a well-cooked and well-served meal. Every one of you, boys and girls alike, whether or not you help to cook the meal, can help to set the table and, when necessary, to serve the meal. In this way you will many times save your mother from taking extra steps. Would it be playing fair to allow her to do all the work of getting the meal, and then of setting the table and of serving the meal, too? Chivalrous boys and kind-hearted girls are not going to allow her to do all this. Besides, the art of table-setting and food-serving is one that every boy and every girl in the land should know something about, so let us learn how to do the work well.

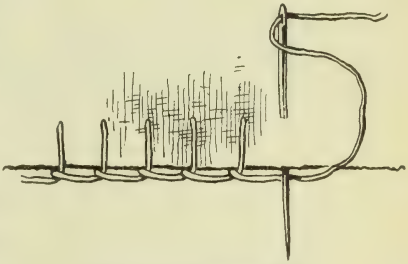


FIG. 1.—*Blanket stitch*

In setting the table we shall first need a silence cloth, a tablecloth, and napkins. Therefore, we should learn how to make them.

The silence cloth.— Materials: canton flannel, white embroidery cotton (coarse Royal Society), needle No. 8.

Cut a square of the material so that it will be large enough to hang over the edge of the table about two inches on all sides.

Trim each side so that its edge is straight and has no loose threads; then use a blanket stitch to finish it neatly (Fig. 1). The stitch is worked from left to right. The material is held over the first finger of the left hand, with the raw edge toward the worker. Take care to make all stitches the same distance apart and of the same depth (three eighths inch from the edge).

The tablecloth.— Materials: table linen, white cotton No. 70, needle No. 9.

Cut the tablecloth larger than the silence cloth. The sides should hang over the edge of the table about one fourth the distance from the table top to the floor. Before cutting, pull out a thread in order to mark the line along which you desire to cut. This line will help to make the edges of the cloth exactly straight. The cloth is to be finished by hemming its raw edges. Turn the raw edges back toward the wrong side of the cloth one fourth inch. Then turn the edges back a second time and make a hem about one third of an inch wide. Baste this in, using about one-fourth-inch stitches. Finish the hem with damask hemming (Fig. 2). Fold the basted hem back on the right side, with the fold of the cloth even with the first fold of the hem. Overhand the folded edges together with fine, uniform stitches taken at right angles to the folded edges.

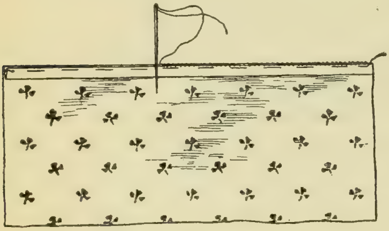


FIG. 2.—*Damask hemming*

Napkins.— Materials: same as for tablecloth.

The napkins are bought by the dozen; a medium size is best. The napkins are woven together and will have to be cut apart. Carefully draw a thread between each two napkins, and then cut them apart along the mark that you made by drawing out the thread. Hem the raw edges as you did those of the tablecloth.

Dishes.— Now that the table linen is ready, let us choose the dishes for our table. In selecting dishes we have to remember what they are to be used for. A cream pitcher should not be so decorated that it requires a long time to clean the outside, nor so narrow-mouthed that it is very difficult to clean the inside, nor so poorly shaped that cream cannot be poured from it without spilling. A plain, well-shaped pitcher which is easy to clean and which pours without spilling is best. When buying we are likely to forget what a pitcher is used for, and to select for the home pitchers that are sometimes worse than useless. Many other kinds of dishes are carelessly chosen; for example, the dish with a scalloped edge, from which apple sauce or other juicy foods are so easily spilled.

In order to obtain the right kind of dishes, you see, we must remember that simple, neat dishes which hold food well and which can be made to shine with cleanliness are, after all, the best. To any other beauty that they have, they may add the beauty of usefulness.

In setting the table it is important to arrange everything for the comfort and the convenience of those who sit at the table, and to make it look as attractive as possible.

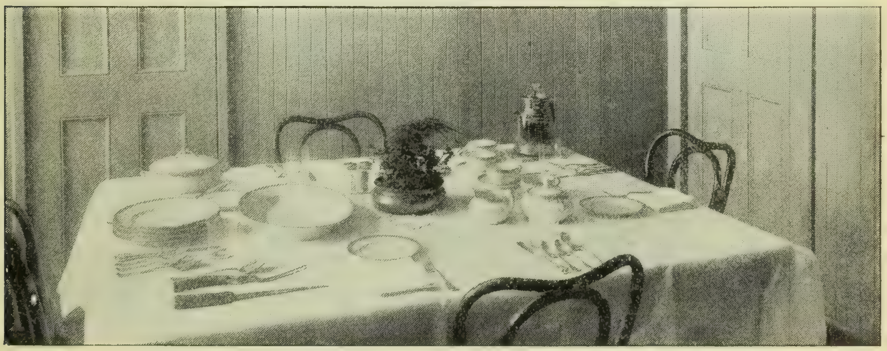
Setting the table.—1. First of all, see that the room is clean and free from dust.

2. Spread the silence cloth smoothly.

3. Lay the tablecloth with the middle lengthwise crease exactly in the middle of the table, and with the edges of the cloth hanging evenly at each end of the table.

4. Arrange the plates at even distances apart around the table, right side up, one inch from the edge of the table.

5. Place the knife at the right, with its sharp edge near and toward the plate. Place the fork at the left near the plate, with its tines up. Place the spoon or spoons beside the knife, bowl up. There should be as many spoons as will be needed for the meal, and they should be placed so that the first to be used is the farthest to the right. The lower ends of knives, forks, and spoons should form a line with the lower edge of the plate, one inch from the table edge. The napkin, neatly folded or in a ring, should be placed beside the fork.



The table correctly set

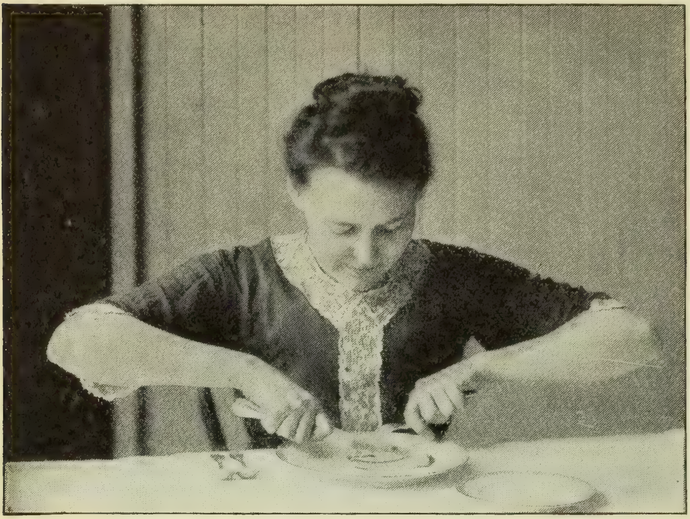
6. Place the tumbler at the right, opposite the upper edge of the plate and the upper end of the knife. Place the bread-and-butter plate, or the butter plate, at the left, in line with the tumbler.

7. See that all places are set alike. Each place is a pattern that is repeated in all the other places; thus a neat border is formed around the table.

8. Be sure that the required serving spoons, knives, and forks, as well as the plates or the saucers for each course, are on the table or that they are put on when the foods for which they are needed are served.

9. Be sure that articles needed throughout the meal are on the table, such as bread and butter, water, salt, pepper, oil, vinegar, and the like.

They should not be carelessly scattered over the table, but should be conveniently and artistically placed. Everything should be ready at the beginning of the meal, so that no one is obliged to leave the table in order to supply a forgotten article.



The wrong way to hold the knife and fork

10. Do not load the table with dishes. Plain spaces are restful.

11. If flowers are used as a centerpiece they should be so low that they do not interfere with any one's view across the table.

12. Endeavor always to have the meal on time, but be sure that it is ready before announcing it. Have the air in the room fresh; see that there is no disorder, that the tumblers are filled with fresh water, that the chairs are in place, that everything needed is ready on the table, and that there is a place, other than the table, convenient for setting things if necessary.

Serving.— 1. Hot foods should be served from hot dishes and on warm plates. Cold foods, such as ices and salads, should be served on chilled plates.

2. Never put too much into dishes. Small servings are daintier and more appetizing than large ones.

3. The host usually serves the main part of the meal. The hostess serves desserts and beverages.

4. If you are not at the table but are waiting on the guests, always pass food to a person from the left, so that he may conveniently help himself with the right hand.

5. In removing a course from the table take all food first, and then from the right side the individual plates and other articles no longer of use. Do not take at one time more dishes than you can remove quietly.

Table manners.— Every rule for good manners is based on good sense and on thoughtfulness for others. Try to see for yourself the reason for the rules of table manners, some of which are printed below:

1. Be on time for meals. Before seating yourself at the table, notice whether you can be of service to others who are to share the meal.

2. Pass dishes in a way most convenient for the one who receives them; for example, do not pass a plate of butter with the knife handle pointing away from the person to whom you are passing the dish, for he would then be obliged either to turn the plate round or to reach awkwardly across the plate for the knife.

3. Do not leave a spoon in a cup.

4. Do not help yourself to more food than you will eat.

5. Keep your plate as neat as possible, and avoid spilling any food.

6. Hold your knife, fork, and spoon correctly.

7. Forks should be used for as many foods as possible. When necessary to use a spoon, the food should be taken from the side of the spoon.

8. Do not reach across the table. Ask for whatever you need.

9. Avoid making any unnecessary noise in eating.

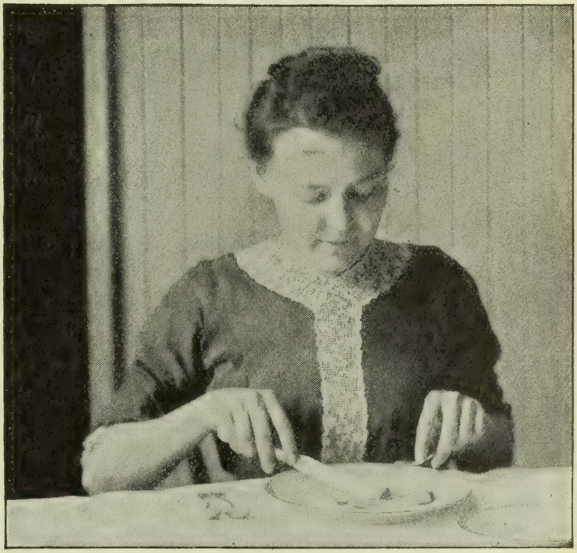
10. Use your knife for cutting only.

11. Keep your arms close to your sides.

12. Do not sip coffee from the spoon.

13. In passing your plate for a second helping, place your knife and fork on the side of your plate toward the right, the point of the knife within the edge of the plate, the fork with its tines pointing up.

14. When you have finished your meal, leave your knife and fork in the position described above.



The right way to hold the knife and fork

15. Do not leave the table until all who are seated at it have finished.

16. Above all, only pleasant things should be talked of at the table. Laughter and good feeling aid digestion.

FEBRUARY

L. H. BAILEY

February!
The land is in the grasp of winter; and yet
A change is stealing over it
Like a breath of far expectancy
On plowland, marsh and hill;
The sun is higher and lingers at the night
As if reluctant to be gone;
A new blue is in the sky;
The grip of the hard hand begins to relax
And here and there the fingers of the frost let go;
There is an impression of warmth in the thin haze;
The cattle stand longer in the farmyard;
Soft moist colors rise imperceptibly in the woods
A strange mystery is astir in the twigs of the orchard trees
Now and then a new lustre is on the evergreens
The brown and yellow willows show themselves along the water-courses
And the fire of the osier begins to kindle in the swamps;
We almost look backward to the dead of winter
And almost onward to the rush of the grass—
We look everywhere!

Betwixt the rigid dead-nights of the year
  And the raucous flux of breaking spring
February lays its faint suggestion here
  And we stand and watch for ev'rything.

Cornell Rural School Leaflet

FOR BOYS AND GIRLS

Published by the Department of Rural Education, New York State College of Agriculture at Cornell University. W. A. Stocking, jr., Acting Director. Entered as second-class matter, Ithaca, New York

ALICE G. McCLOSKEY and EDWARD M. TUTTLE, Editors

ARTHUR D. DEAN, C. EDWARD JONES, G. F. WARREN, and C. H. TUCK, Advisers

Vol. 7 ITHACA, NEW YORK, MARCH, 1914 No. 4

"Great deeds cannot die;
They with the sun and moon renew their light
Forever, blessing those that look on them."
Alfred Tennyson

A LETTER TO GIRLS AND BOYS

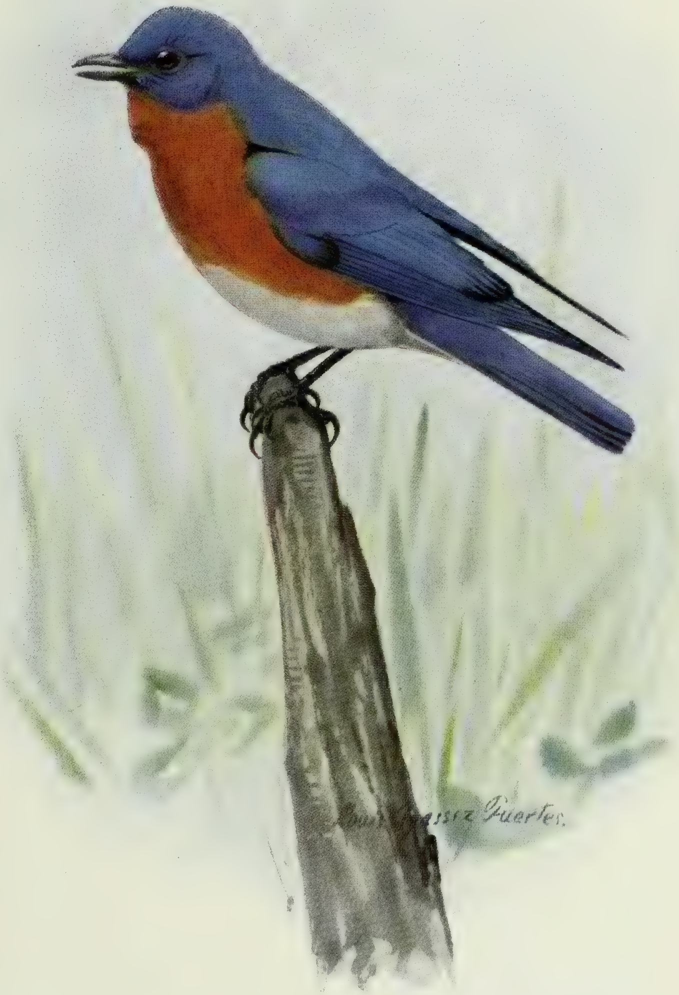
Dear Girls and Boys:

March days are come, and April showers are on the way. What a sturdy month is March! It marks the great change from winter to spring. It brings boisterous winds that sweep the earth and make the air fresh and sweet. Ice breaks up, the ground begins to settle, and from the top of yonder tree a robin pours forth his cheery song. April follows, and with its warming rains washes away all traces of the winter's rigor. In forest, field, and meadow, in orchard, pasture, and dooryard, the plant world begins to stir and to send forth its brightness.

Gradually everything is changing: day by day buds are bursting into leaves and blossoms; grasses are sending up thin, green, tender shoots; flowers are opening to the sky. It has always seemed wonderful to me that some of the daintiest and the most fragrant flowers should come forth so early in the year when late snowfalls may be on the way; but after the cold white covering vanishes, the flowers are apparently none the worse off. Do we not all love hepaticas, anemones, spring beauties, and the sweet arbutus? In our dooryards, too, tiny snowdrops peep through first and then crocuses, daffodils, and tulips, followed soon by all the wealth of the late spring and the summer bloom.

Springtime is growing time. It should be growing time for folk as well as for flowers. With it comes the desire to sow seeds that will ripen for a harvest. There are many kinds of seeds, and girls and boys can help to sow them.

First, there are the true seeds — the garden seeds that you obtain from the seedsman. In this leaflet, on page 293, there is an article that I hope you each will read carefully. We have tried to make it simple and direct, and we shall be glad to hear that it has helped you to have a garden this summer that is truly worth while. Last year I had a garden near the schoolhouse in which we have our office, and it was an endless pleasure to me to work in it for an hour or so each day and to help the plants along. You remember how dry the season was! Yet my garden grew well without watering because, after every rain, I raked it over and kept the dry dust mulch on top and the moist, firm soil below. This summer I hope to have a garden the size of the one described in the article on page 293 and to carry out the plan given there as faithfully as possible. In that way I shall find out whether the plan is practical for the region about Ithaca. Perhaps many of you will find that you can easily make your garden of the same size as the one indicated on the plan. Next fall you can write me about it, and we can compare notes for different parts of the State. At any rate, have some kind of a garden and spend part of your summer with growing things.


Louis Agassiz Fuertes.

BLUEBIRD

SUPPLEMENT TO
CORNELL RURAL SCHOOL LEAFLET
VOL. 7, NO. 4, MARCH, 1914

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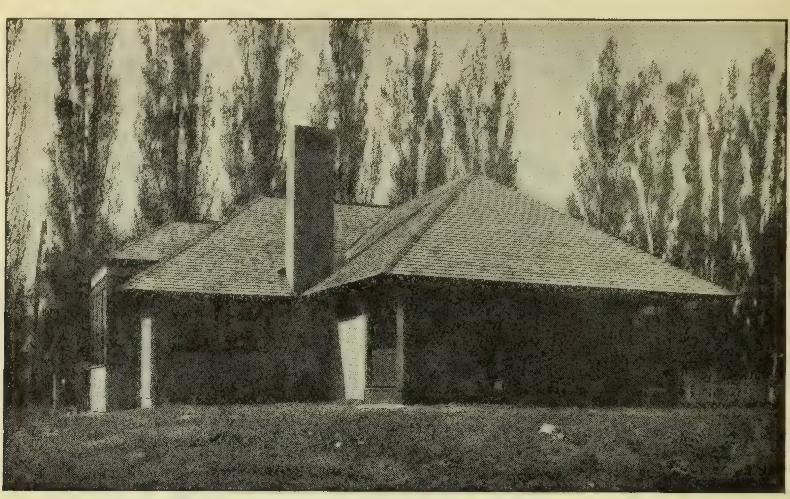
There are other kinds of seeds that you can sow. They are imaginary seeds, but they grow and produce a harvest just as surely as do the real seeds. For example, there are the seeds of industry. Seeds of industry may be fostered by poultry-keeping, and many of you might read again the article in the January leaflet and begin on April first to take charge of the home flock. Caring for the poultry will then be your task, your responsibility, and you must be faithful and make good at it, so that a year from now the flock will be larger and more vigorous, and also, will have produced more eggs because of your care. Each task that you may undertake during the coming summer is a seed that you sow. Whatever it is, the same thought and the same preparation are necessary as for the garden seed. I can imagine Ruth agreeing to keep a room in order. Perhaps Olive will make all the beds each day. Sam will see that the wood box and the water pail are always full. Joe will mow the lawn and keep the yard in order. Each one will have a definite responsibility and meet it faithfully.

Breaking ground

Arbor Day is coming and with it another opportunity for seeds of industry to be planted that will make the school yard more attractive. This year the date set for Arbor Day is very late. I think that you will find it better to set out trees and shrubs earlier and then have the exercises on May 8. On page 1235 there is a short article that tells how to do the planting. You will see that it should be done early, before the leaves start, in order to have the best results. I hope that this year some of you will consider planting shrubs about the building, as well as trees in the yard. I have seen school yards that had enough trees, but very few have shrubbery. Look at the pictures on this page and the one opposite. They show the schoolhouse at Cornell just after it was built and as it looks to-day. You will not hesitate in deciding which is the more attractive, for the appearance of the building is wonderfully improved by the planting about it. A few shrubs that can easily be found in a neighboring pasture or wood may be as satisfactory as expensive nursery stock. The taller kinds should be planted next the building between windows or at a corner, and the smaller ones in front, with the medium-sized shrubs between the two. Vines can be trained over a porch at the doorstep or over the screening for outhouses. Some of the shrubs and vines that you will be able to find are as follows:



The schoolhouse at Cornell before the grounds were planted

Nannyberry, sheepberry, or wild raisin — tall shrub
Common elder — tall shrub
Red-berried elder — medium tall shrub
Red-twigged dogwood — medium tall shrub
Barberry — medium shrub
Maple-leaved viburnum, or arrowwood — medium shrub; grows well in shade
Laurel — medium shrub; evergreen
Wild roses — grade according to size; plant in mass or clump
Fragrant sumac — low shrub

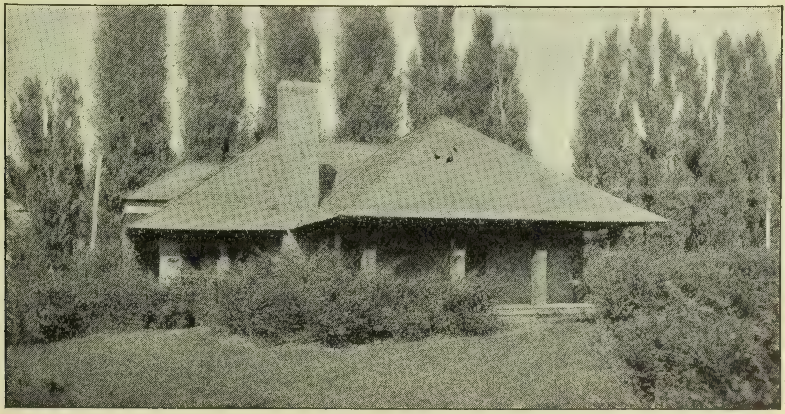
Japanese honeysuckle — twining or trailing shrub
Virginia creeper — vine
Climbing bittersweet — vine

Make a start this year in planting shrubbery and vines, and each year add to them until they surround the schoolhouse and screen the outbuildings. You will be surprised at the difference this work will make and how much pleasure it will give to every one.

In spring, birds come north again, animals and insects once more abound, and trees, flowers, and weeds begin to grow. All Nature is alive, and there is a fine opportunity to study outdoor life. I hope that all the girls and boys who read this letter will sow seeds of observation, seeds of interest, and seeds of sympathy as they roam the fields and woods and pastures. Read over the letter in the January leaflet in which I spoke about keen, trained senses, and the true spirit of the naturalist.

I could tell you of many other seeds that are good to sow: the seed of healthfulness, which makes the body strong in order that the mind can develop; the seed of helpfulness, which gives happiness to those who help others; the seed of cheerfulness, which brings smiles instead of frowns, and pleasant words instead of irritable ones; the seed of joyousness, which helps one over the hard places and makes it possible always to see the bright side of things, and which brings song and laughter and merry sport.

Not all seeds are good seeds. As in our garden we must not neglect the weeds, so with these imaginary seeds we must try not to sow weeds and must root them out quickly if they begin to sprout. Weed seeds are those of idleness, selfishness, jealousy, peevishness, disrespect, ill manners, and a host of others. Like real weeds they start quickly, grow rapidly, and require constant watchfulness.



The grounds after planting

During the coming months I shall try to visit some rural schools. It will not be possible for me to be away from the office for a whole month at one time, because you are writing so many letters that I want to read. But I shall go out often for a week or more at a time. In this way I may come to your school any day, and if I should be with you for a few hours I know you will be ready and eager to make the most of our time together. You may be sure that I shall be ready to learn from you.

Write often between now and next fall. In school or out of school send me word of something that interests you whenever you can. Always be sure to give the school district number, township, and county so that you may receive credit for your letters. The gift picture is ready and is being sent to all who have written three letters since last September. There is plenty of time still for those who have not done so to earn a picture. After you obtain it, I hope you will want to keep on writing because you feel that we are friends.

I am sorry that this is the last letter to you for the year. It is a long time until the next letter, in November; but it will not seem so long, if you write to me often, if you let me feel that you are interested in the life around you, that you are playing, working, living, with joy and hope and courage, that you are sowing many seeds which are growing into fine, strong plants, that you are my friends as I am

Your friend,

Edward M. Tuttle

Cleaning up the school grounds

LETTERS FROM GIRLS AND BOYS

District 5, Town of Otselic, Chenango county
South Otselic, New York, December 1, 1913

Dear Mr. Tuttle:

I wrote to you last year and I am going to write to you again this year. I like to write to you very much. I am nine years old and I am in the fourth grade. My birthday is in October. My teacher's name is Mabel Angell.

We learned a few little manners instead of writing class Tuesday. The boys took the girls to church and the boys waited at the end of the seat while the girls went in. Then we had one aisle for a street and the boys met the girls and tipped their hats.

We destroyed about nine hundred and eighty tent-caterpillar's nests last year and we are going to try and destroy more this year.

We have a very pleasant schoolroom. We keep our school lawn very nice and do not throw papers on it.

I like to read and spell very well. I have read nearly every book in our library. I like to read " Little Lord Fauntleroy " best.

Your friend,
CATHARINE ANGELL

Editors' note.— We like this little letter written by Catharine, and we are very glad that she mentions the teaching of manners in her school. The cultivation of gentle manners often seems unimportant to boys and girls, but it is a fact that many lives have been defeated because persons have been misunderstood and misjudged owing to their crude habits of speech and action. Every girl should look forward to being a gentlewoman, and every boy to being a gentleman.

District 3, Town of Southold, Suffolk county
East Marion, New York, March 22, 1913

Dear Mr. Tuttle:

I have lived in a country village of eastern Long Island all my life and was always fond of birds and wild flowers even though I knew only a few of the most common by name. Until recently, ill health prevented me from attending school and I received no regular instruction in nature study. I learned some things about cultivated flowers from my mother, and both parents encouraged me to read books on nature. It was while reading some bird magazines that the idea occurred to me to find some species that would be new to me and to learn about them.

I began the work in our garden, and almost all of the eighty-eight species of birds and one hundred thirty-four wild flowers I have since identified, have been seen within a mile of my home. I have found field glasses to be very useful, and indeed I consider it a difficult matter to carry on the study of birds without them. I have often been surprised, however, at the close approach most species will allow. I think birds fear noise more than anything else, and the more slowly and quietly one moves when studying them the better. While looking for birds, I found many wild flowers with which I was not familiar. I brought specimens of these home and named them by comparing them with pictures and descriptions in books on the subject. I have read many books on birds and wild flowers, but the two I like best are Reed's " Bird Guide," and " How to Know the Wild Flowers " by Mrs. William Starr Dana.

Migration seasons are particularly interesting to me because a great many birds that spend the summer farther north can be seen here only at that time. Also, many of the birds that nest here are more easily observed during the spring migration, as they often stop a while in our garden or on the edge of the woods before seeking the deep woods for the summer. The most interesting bird families whose nests I located last year were those of a screech owl, a flicker, and a downy woodpecker. The owl's nest was in the limb of an old apple tree in the garden, and the others were in hollow trees on the edge of the woods back of the garden. The flicker has had its nest in the same tree for several seasons. I have been noticing the songs and calls of birds for the past year and can recognize by their song or call-note over half the birds I know by sight. It is also easy to tell some birds by their flight. Any one can tell wild geese by their wedge-shaped flock, or swallows by their rapid, graceful, sweeping flight. I have enjoyed watching the flocks of juncos, myrtle warblers, and tree sparrows that are spending the winter in some cedar woods a short distance from my home.

I have been interested in these things for about a year and a half and can truly say that I do not know of anything I ever undertook that has been of more pleasure and profit to me. I know my health is better for the out-of-door exercise. When I entered school I found the work that I had done alone made the nature-study lessons easy for me, and also that my teacher's explanations helped me to understand my own work better. The Young Folk's Society, of which I am a member, has also helped me.

I am certain I have accomplished no more with this work than any boy or girl with a little patience and a love of nature can do. To those who do not think it would pay them to take an interest I can only say, " Try it and see."

Sincerely yours,
MABEL R. WIGGINS

Editors' note.— What interesting reading Mabel has provided for the leaflet this time! She makes us wish that we might go down to East Marion and go out with her into the highways to study birds and wild flowers. Her methods of seeking information are worthy of a true naturalist, and we know that she will enrich her life and that of those about her by her patient study of nature. We wish to commend her humility in stating that what she has accomplished any boy or girl with a little patience and love of nature can do also.

We hope you will notice the excellence of the English in this letter. It is a real asset for any one to be able to write correctly and in an interesting manner.

District 1, Town of Mohawk, Montgomery county
Tribes Hill, New York, December 16, 1913

Dear Mr. Tuttle:

I am a boy of thirteen years old. When our school had decided to write you a letter, I was chosen to do the work, and so I will tell you what we are doing.

We have a water jar with cover and each pupil has his own drinking cup.

The floors are oiled several times during the term to prevent dust, and the district has just put new seats in the schoolroom.

Last year Mrs. Dodge offered as a prize enough tulips for a bed to any school in the town which had the best kept lawn or school grounds for the year. Our school got the bulbs.

Hiawatha and Minnehaha

At the close of school the pupils had a play called " Hiawatha," and it was enjoyed by all. It was composed of six acts including a drill which was given by eight boys. I will send you two pictures that were taken in the play. There were three songs that kept the people in good humor. The pupils decorated it themselves, and the visitors thought it looked like a real woods. The play was held in the evening and we had a good crowd.

We are studying your leaflets and like them very much.

Your friend,
JOHN J. GOING

Editors' note.— When John's letter was received at the office we decided that it ought to be published. In the first place, it is a direct letter that gives us much information about the work of the school. We like to hear of improvement in the buildings because we believe that boys and girls will do better work if their surroundings are attractive.

We wish that we might have seen the little play " Hiawatha." There is a great deal of real education in dramas. We are hoping that more and more rural schools will have simple entertainments that will include some play based on good literature. We hope that, whenever possible, these little dramas will be given out of doors. Some schools have had very successful entertainments in this way. One given last summer here at Cornell was much enjoyed by students and visitors. It was given in the evening in the quiet, fragrant out of doors. The orchestra was made up of crickets, and they played so well that the audience was silent while waiting for the entertainment to begin. The stars were very sparkling and beautiful, and a gentle wind made harmony among the tree tops. Some day we shall tell you about the little play.

The entire cast of the play

District 1, Town of Granger, Allegany county
Hunt, New York, November 13, 1913

Dear Friend:

I am writing you, this cloudy afternoon at my desk in school, a letter telling you something about myself and my school work.

I am a boy fifteen years of age residing in the town of Granger in the northern part of Allegany county. I live with my father and mother on a farm of about a hundred acres. I am going to be a farmer because I think the farm is the best place for country boys. Farming is a good, honest occupation and should not be despised by any one.

I am attending school at Short Tract, a small village about four miles from my home. I walk to school every day at present. It is quite a walk, but it does me good. My boarding place, where I shall stay in bad weather, is right next to the schoolhouse.

At present I am studying eighth grade English and arithmetic, hoping to pass them both in January. Having passed all my other graded work I am anxious to overcome these as soon as I can. I am also studying spelling and first-year high school English, which is " Ivanhoe " now. There are six people in this class. I like Ivanhoe very much. It is a fine book.

In the eighth grade arithmetic class there are also six pupils. We are working examples in stocks and bonds and are having quite a time with them, but we will master them all right.

As I must have this letter finished before class time which is most here, I will close now, and hoping that you will be glad to hear from me and expecting to write again, I am

Your true friend,
EDWARD C. R. SMITH

Editors' note.— Edward's letter has interested us for many reasons, but, perhaps most of all, because it indicates his cheerful outlook on life. A great writer, Robert Louis Stevenson, said, " A cheerful man or woman is a better thing to find than a five pound note. He or she is a radiating focus of goodwill, and their entrance into a room is as though another candle had been lighted." We feel that cheerfulness often becomes a habit, and it is a very good habit to form. Whatever our life may be, there is some brightness connected with it and we should find it.

It is encouraging to those interested in agriculture to have a boy express his intention of finding his life work in the open country. Edward recognizes the dignity of farming and the fact that a high type of intelligence and resourcefulness is as necessary for success in that line as in any other.

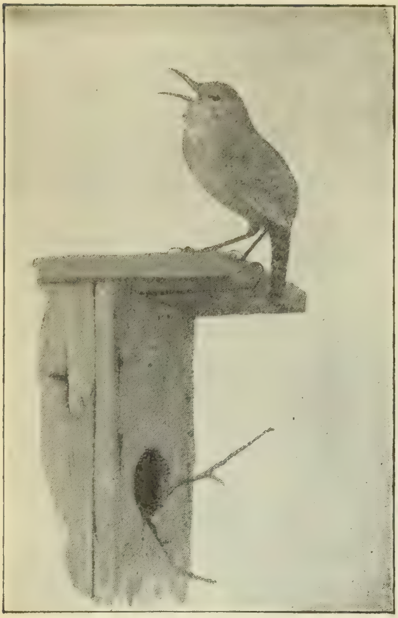
We are glad that Edward likes " Ivanhoe." We wish every boy of fifteen years of age would read this book. It can be obtained from almost any village library.

BIRD STUDY

The birds for study in the schools of New York State this year are very interesting. We should try to see every one and, if we have a good picture of each in our minds, we shall recognize any one of them that we may meet on our walks to school.

We shall ask you, therefore, to look very carefully at each picture on pages 1208 and 1209. Trace each one, and transfer the outline to drawing paper. If you have paints or crayons, color each copy according to the descriptions on page 1210. Then throughout the spring and summer try to see each bird and observe in what ways you have perhaps mistaken the colors. Send us samples of your work.

Naturalists are always on the lookout for forms of life that they have never seen. They often study pictures and descriptions of birds that they hope to see. Sometimes they find a bird of which they have never



House wren

Catbird

Song sparrow

Robin

Wood thrush

Sandpiper

Ovenbird

Chimney swift

heard. In such cases they are most careful to keep accurate records of the place, the size, and the coloring of the bird, of its song, and of all possible details of the discovery. Since we are going to try to be naturalists we must imitate all such careful methods of study.

Make an effort to learn one or more of the quotations on pages 1211 to 1213. Then some beautiful spring morning when the birds are singing in field and wood near your school, perhaps the teacher will ask you to give the quotations as a part of your morning exercises. Be sure that the windows are open so that you can hear the singing of the birds while you recite the beautiful thoughts that some bird lover has expressed in verse.

DESCRIPTIONS OF BIRDS

Robin.— Size: This bird is used as one of the standards for comparison. It is about ten inches long.

General color: Upper parts grayish slate; under parts, except middle of lower belly, reddish or rusty.

Junco, " Snowbird."— Size: About the size of an English sparrow.

General color: Slate color except for belly, which is white.

Distinctive features: When flying it displays white outer tail feathers. This, with its unstreaked slaty color, will distinguish it.

Song sparrow, " Ground bird."— Size: About as large as an English sparrow.

General color: Upper parts, brown streaked with darker brown; under parts, grayish white streaked with brown.

Distinctive features: The streaks on the breast converge into one large spot in the center of the breast. It is one of the most common of our native sparrows and is always found in the neighborhood of bushes or thickets.

House wren, " Jenny wren."— Size: Smaller than the English sparrow.

General color: Upper parts, brown; under parts, lighter.

Distinctive features: Its small size, unstreaked brown coloration, and habit of carrying its tail erect will distinguish it from all but the winter wren. The latter is very rare in New York State during the summer, except in the mountains. It is a darker bird than the house wren and is much more terrestrial, dodging like a mouse about logs in the woods.

Ovenbird, " Teacher bird."— Size: Slightly larger than the English sparrow.

General color: Upper parts, uniform olive-brown; under parts, white, streaked with black.

Distinctive features: On the top of the head is an orange-brown patch. This characteristic, together with its general color and habit of walking about on the ground in dry woods, will distinguish the bird. Its song resembles the words, *Teacher, teacher, teacher*, repeated with increasing rapidity.

Chimney swift, " Chimney swallow."— Size: About the size of an English sparrow.

General color: Uniform grayish black or fuscous.

Distinctive features: This bird is seldom seen except when flying, when it appears very much like a swallow but with narrower wings. It can be distinguished from all the swallows by its uniform sooty coloration and its apparently pointed tail. It nests in chimneys.

Wood thrush, " Song thrush."— Size: Smaller than a robin.

General color: Upper parts, brown, brighter on the head; under parts, white, with large round black spots.

Distinctive features: The large round spots scattered over the snowy white underparts will distinguish this bird.

Sandpiper, " Spotted sandpiper," " Tip-up."— Size: Larger than an English sparrow, and with long legs and bill.

General color: Upper parts, brownish gray; under parts, white, with dark spots.

Distinctive features: This bird is found along creeks and lake shores. Its long legs and bill will distinguish it from all but other species of sandpipers. From these it can be distinguished by its spotted underparts and its habit of teetering.

Flicker, " Golden-winged woodpecker," " High-hole."— Size: A little larger than a robin.

General color: Upper parts, dark brown; under parts, light brown, marked with a black crescent and round black dots. Quill feathers of tail and wings black above, golden yellow below.

Distinctive features: A scarlet crescent across nape of neck; white spot to be seen on the rump when flying; the flicker is our only brown woodpecker.

Catbird.— Size: Smaller than a robin.

General color: Uniform slaty gray, with a black crown and a chestnut patch beneath the tail.

Distinctive features: Its slender build, uniform gray color, and habit of keeping to the thickets will distinguish it.

QUOTATIONS

From out the white and pulsing storm
I hear the snow birds calling;
The sheeted winds stalk o'er the hills,
And fast the snow is falling.

* * * * * * * *

O cheery bird of winter cold,
I bless thy every feather;
Thy voice brings back dear boyhood days
When we were gay together.

JOHN BURROUGHS

There is a bird I know so well,
It seems as if he must have sung
Beside my crib when I was young;
Before I knew the way to spell
The name of even the smallest bird,
His gentle-joyful song I heard,
Now see if you can tell, my dear,
What bird it is that, every year,
Sings, " Sweet — sweet — sweet — very merry cheer."

* * * * * * * *

I like the tune, I like the words;
They seem so true, so free from art,
So friendly, and so full of heart,
That if but one of all the birds
Could be my comrade everywhere,
My little brother of the air,
This is the one I'd choose, my dear,
Because he'd bless me, every year,
With " Sweet — sweet — sweet — very merry cheer."

From " The Song Sparrow "
by HENRY VAN DYKE

Rollicking robin is here again;
What does he care for the April rain?
Care for it? Glad of it. Doesn't he know
That the April rain carries off the snow,
And coaxes out leaves to shadow his nest,
And washes his pretty red Easter vest,
And makes the juice of the cherry sweet,
For his hungry little robins to eat?
"Ha! ha! ha!" hear the jolly bird laugh,
"That isn't the best of the stay by half!"

LUCY LARCOM

In the days of spring migrations,
Days when warbler hosts move northward,
To the forests, to the leaf-beds,
Comes the tiny oven-builder.

* * * * * * * *

Hour by hour his voice he raises,
Mingling with the red-eye's snatches,
Answering to the hermit's anthem;
Rising — falling, like a wind breath.

From " The Oven Bird "
FRANK BOLLES

A dainty, delicate swallow-feather
Is all that we now in the chimney trace
Of something that days and days together,
With twittering bird-notes filled the place.

Where are you flying now, swallow, swallow?
Where are you walking the spaces blue?
How many little ones follow, follow,
Whose wings to strength in the chimney grew?

MARY BARBER DODGE

Where the violet shadows brood
Under cottonwoods and beeches,
Through whose leaves the restless reaches
Of the river glance, I've stood,
While the red-bird and the thrush
Set to song the morning hush.

MADISON CAWEIN

Across the narrow beach we flit
One little sandpiper and I,
And fast I gather, bit by bit,
The scattered driftwood bleached and dry.
The wild waves reach their hands for it,
The wild wind raves, the tide runs high,
As up and down the beach we flit,—
One little sandpiper and I.

CELIA THAXTER

Wake once more the liquid strain
That you poured, like music-rain,
When, last night, in the sweet weather,
You and I were out together.

Unto whom two notes are given,
One of earth and one of heaven,
Were it not a shameful tale
That the earth-note should prevail?

From " The Catbird "

PHOTO BY VERN MORTON

The eggs of valuable birds should be protected

THE SANDPIPER

A. A. ALLEN

"Sweet, sweet, sweet," says the sandpiper as he balances himself on a rock and tilts backwards and forwards on his stilt-like legs. "Sweet, sweet, sweet," he calls as he flies up the creeks or runs through the shallow water, probing here and there with his long bill for hidden insects. The boys call him a "Tip-up" or a "Teeter-tail," because he does not seem to be able to stand still as most birds do but continually tilts his tail as though it were difficult to keep his balance.

There are many kinds of sandpipers along shores and mud flats during spring and fall when they are migrating, but only the spotted sandpiper, or "Tip-up," stays with us during the summer. No stream is complete without him. Sometimes his gray back and spotted white breast so blend with the gravel of the creek bed that we do not see him as we pass; but he is there, as much a part of the landscape as the bridge and the willow, balancing himself quaintly on a bowlder and bobbing and bowing to us.

Let us walk up the creek in June and find the four brown eggs spotted with black that are hidden away in a tussock near the water. We almost step on the brave bird before she flutters from the nest, feigning a broken wing, and trailing over the ground just out of reach until she has enticed us from the nest. Then she flies off up the creek, showing us that we have been deceived. If we stop, however, when she flutters from beneath our feet, and search about in the grass we may find the eggs. We shall marvel at their size when the mother bird is so small. We shall notice how the smaller ends of the eggs all point toward the center of the nest, making it more comfortable for the mother bird during the long hours. The eggs are very dark and opaque and we know that they will soon hatch, so we plan to come back again in a few days. When we arrive the nest is empty, for young sandpipers are not blind and helpless when they are hatched as are many birds, but like chickens they are covered with down and are able to run and hide. A careful search reveals them, however, hiding under leaves and sticks — little gray fellows with long wobbly legs and none of the grace of their parents. They lie perfectly still when we find them and look more like leaves or stones than like live birds. It is only when we are not watching that they get up and run.

In fall the sandpipers travel thousands of miles to South America where they spend the winter, but in spring they come back once more. Very frequently the same bird spends year after year along the same stream.

TREES

This year the trees given for study in New York State are as follows: elm, spruce, pine, juniper, walnut, dogwood, maple, sumac, oak, fir, tulip tree, two kinds of fruit trees, and one conifer. Boys and girls will have many opportunities to become familiar with some of these.

Dogwood

We should all try to know the trees that grow about us whether in garden, woodlot, or forest. This study will be of interest through all our lives, in all lands. When we consider that small seeds may be sown from which tall trees will grow, we feel like doing our part so as to add beauty and interest to the world by planting a tree and caring for it until it has opportunity for a long and useful life.

We often appreciate out-of-door things better when we know something about them and can daily add some new interest to this knowledge. It is well, therefore, to consider the trees for study this year, and to gain some information on which further study and observation may be based. We ought to know in what climate and soil each tree will best develop, whether it has slow or rapid growth, how high it will grow, at what time it blossoms, the kind of bark and leaves it has, and the ways in which the wood or fruit may be used.

It will interest some of the older boys and girls to prepare an outline for tree study as given on page 1216 and to obtain information from the teachers' leaflet for September, or from a good book on trees, such as "Our Native Trees," by Harriet Keeler, published by Scribner & Sons, of New York, at two dollars. Nature study is the study of nature, not the study of books, but from the works of naturalists we can often obtain information that will help us in out-of-door study.

Outline

- Elm
  - 1. Where it grows
    - Temperate climate
    - Moist soil
  - 2. Growth
    - Quick
    - Sixty to one hundred feet
    - Long life
  - 3. Bark
    - Dark gray
    - Rough, with longitudinal ridges
  - 4. Blossom time
    - March or April, before leaves
  - 5. Leaves
    - Alternate
    - Four to six inches long
    - In autumn turn brown or golden yellow
  - 6. Uses
    - Cooperage
    - Hubs of wheels
    - Saddle trees

Some day when your teacher goes with you on a field trip, take your leaflets with you. As you come to any of the trees mentioned in it, discuss the facts of interest that you know about them. Mabel might tell the color of the bark; John the height of the tree as nearly as he can calculate it; Tom the time that it blossoms; Mary its uses; Margaret its length of life; Peter its value as a shade tree; and Harry will doubtless think of some point of interest that no one has mentioned. This will be the best kind of a lesson.

"*In the urgent solitudes*
Lies the spur to larger moods;
In the friendship of the trees
Dwell all sweet serenities."

ETHELWYN WETHERALD

A SCHOOL GARDEN

AN increasing number of persons, young and old, take an interest in gardening from year to year; and this is well. Gardening helps to make folks stronger, happier, and more useful. From gardening many lessons can be learned, and this is why school gardens are being established throughout the United States. By means of a garden a person can learn to be thrifty, accurate, painstaking, persevering. He can work out problems in arithmetic. He can learn a good deal of agriculture and natural history. By means of a garden he can supply food and flowers for the home or for market.

In many places boys and girls are interested in school gardens and home gardens. On page 1221 you will find suggestions for home gardens. Here, we shall say something about school gardens.

Throughout the United States there are hundreds of school gardens in which teachers and boys and girls all work together in order to make a piece of ground produce something worth while. We wish you could see how eager some schools in large cities are to obtain a little plat of ground.

Children's garden. Public School 52. New York City

Let all of us who live in villages and in the open country, where it is easy to obtain the use of land, make the most of our opportunities.

A children's garden. Brockport Normal School

Many teachers and boys and girls will ask, "What shall we do in school gardening this year?" We cannot answer this question fully because we do not know how your grounds are arranged or how many pupils there are in the school; but we can give some general suggestions that will help you all to make gardening a part of your school exercises.

First, it will be well to have a definite purpose in mind. Each of the following suggests a good kind of school gardening:

1. Make the school grounds more attractive by planting trees, shrubs, perennial herbs, and the like. See the teachers' leaflet for September, page 200.

2. One large garden for the entire school, planted to corn for next year's Corn Day exhibit. This will have to be taken care of in summer, and in some country schools the children have been faithful in gardens of this kind, keeping the crop in good condition during vacation.

3. A garden divided into individual plats, in which are grown vegetables and flowers that mature early or need but little care in summer.

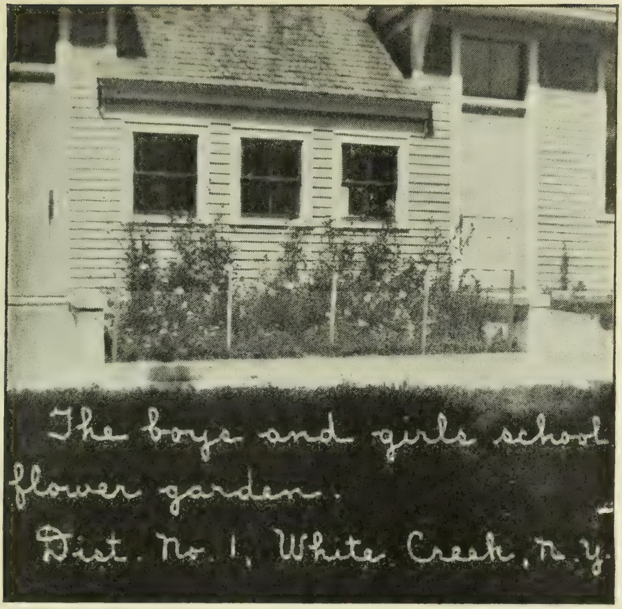
4. An experimental garden, in which some farm crop, such as alfalfa, is grown for special study.

5. A garden in which flowers or vegetables are grown that at the close of school can be transplanted to the home garden.

Another view of the garden

6. A wild garden. We know of a most attractive border about a home lawn, made up of wild plants that have been brought from the woods.

GROWING FLOWERS



A two-cent packet of flower seeds will give more joy than any boy or girl can realize who has never had a flower garden. A small space can easily be found at home or school for nasturtiums or poppies, or some of the other cheery plants. Do not fail to include at least one packet of flower seeds in planning for your garden. On page 1230 you will find instructions for planting the seeds.

But if you have no money to send for seeds, look about you in your own neighborhood and decide how you can help to increase the flowers in your community. Many flowers that grow from year to year with little care can be obtained from neighbors who will be willing to share their plants. From one garden on a little, old time street there were yellow roses, peonies, lilies of the valley, and lilacs in very many of the neighbors' gardens.

How very beautiful the Harrison's yellow rose is, and how even a little child can feel the wonder of its fragrance! The root of this rose can be divided. If a division be planted in a mellow soil where it will not be disturbed, it will doubtless grow into a shrub. We wish that there might be a yellow rosebush in every school garden.

Then there are lilacs in almost all farm communities and they are so satisfying. All children love the beautiful sprays of purple and white, and the grown folk can connect with this fragrance memories of their own child days when life was full of wonder. Lilacs should be planted in much the same way as roses. It will be well to ask advice from some one in the neighborhood who has been successful in making division of the lilac plants. They are rank growers and should be put in the background, preferably eight to ten feet from a fence, or they should be used as a part of a mass of shrubbery. The soil in which they are planted should be fairly rich, because lilacs are permanent and will remain for years. They should be planted in spring before growth starts, but it is possible to divide lilacs when they are in full leaf.

We must not forget lilies of the valley. They should grow in every community so that we may have them in our homes. There is no flower more loved. The lilies of the valley should be planted in a prepared bed in a shady location. They will grow in dark corners, or against a house; in fact, ground in which nothing else will grow can be used for lilies of the valley. The upper soil should be turned out, and new soil that is extremely rich should be mixed with the upper soil until the bed is fully made. Every four or five years the plants should be divided, and at least half the bed should be taken out and given to some one who is not so fortunate as to have lilies of the valley in his garden.

QUOTATIONS

The child, the seed, the grain of corn,
The acorn on the hill,
Each for some separate end is born
In season fit, and still
Each must in strength arise to work the almighty will.

ROBERT LOUIS STEVENSON

" Sooner or later, every person feels the desire to plant something. It is the return to Eden, after the long estrangement of our artificial lives. One of us dreams of a little patch of orchard bounded by cool grassy banks, another wants a snug and tidy garden-plat bounded by a wall and a lattice, and at one side a tinker's room of tools, rakes, and hoes and watering cans, and assorted sizes of pots, and boxes containing string and labels and screws and bits of wire. In this room he would work when the rain falls heavily on the roof and pours across the doorway from the wide-hanging eaves. Others want long trim rows of strawberries, beets, and onions, with beds of lettuce, hills of squashes, and clumps of hyssop and sage in the corners, all ranged and labeled as the books on a shelf. Others want tumbling piles of vines shot through with wild asters and the spires of hollyhocks. Still others would roam afield and find their satisfaction in the things that by chance have found a place in which to grow."

L. H. BAILEY

THE HOME VEGETABLE GARDEN

Note.—This article is for the older boys and girls who want to have a garden that will provide good food for the home table.

If you have followed the suggestions in the January leaflet, you each have located your home vegetable garden and you know how large the piece of ground is. You have been thinking over what you are going to plant, and doubtless you have made your garden plan on paper. Perhaps it will help if we give you a garden plan in this leaflet. Of course this garden plan will not correspond exactly to your plan, but it may suggest ideas to you. Your garden plot may not slope to the south nor be exactly straight sided, but you will have to do as well as you can with what you have. Do not let any obstacle discourage you. Study your own land, and make the very best use of it. That is what we all have to do.

Let us suppose that we have a plot of ground 30 x 50 feet with the long side running east and west and the short side sloping gently to the south. We want to grow a good variety of vegetables, and we decide on the following:

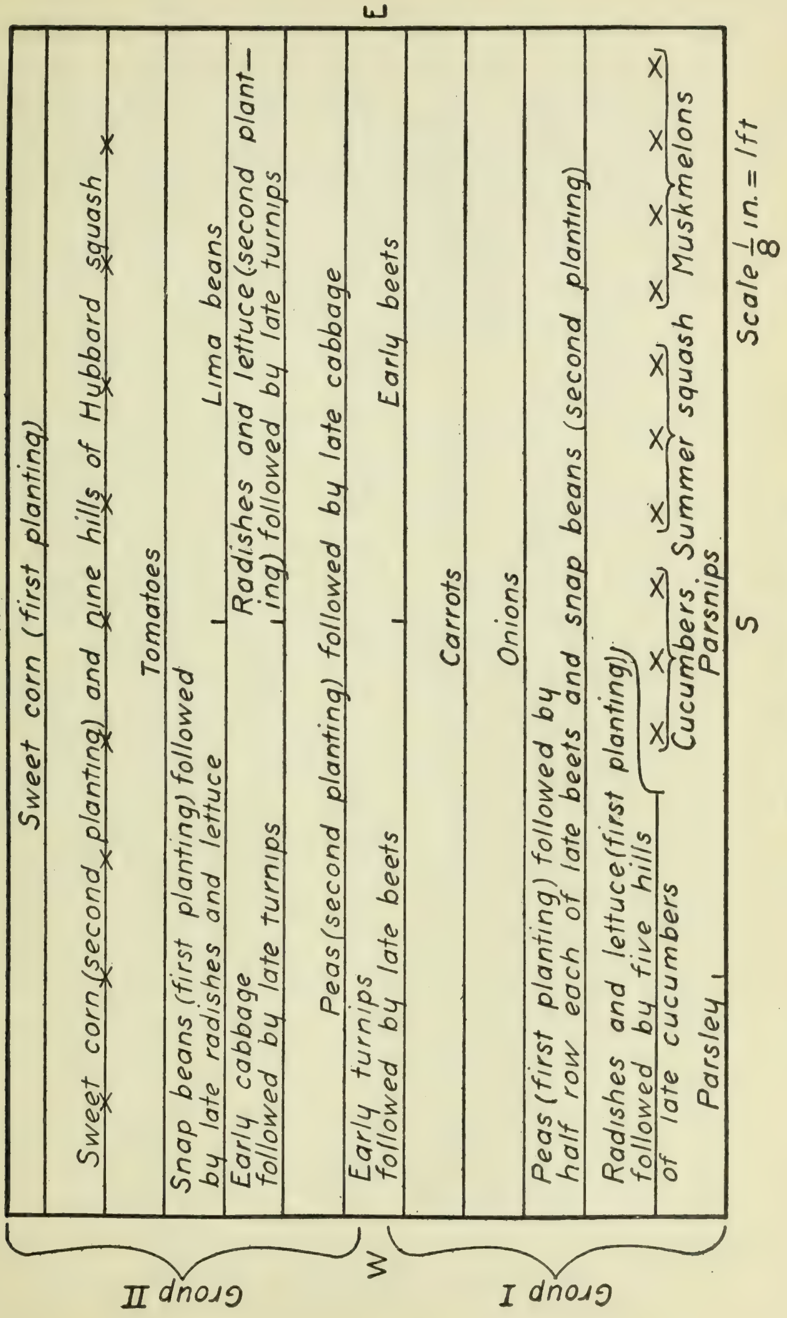
beans, Lima
beans, snap
beets
cabbage, early
cabbage, late
carrots
corn, sweet
cucumbers
lettuce
muskmelons
onions
parsley
parsnips
peas
radishes
squash, summer
squash, Hubbard
tomatoes
turnips, early
turnips, late

The first thing to do is to take a clean sheet of paper and determine on a scale of measure; for example, let every inch on the paper stand for eight feet in the garden. Then each foot will be represented on the plan by one eighth inch of space. In order to avoid confusion let us make all rows two and one half feet apart with the exception of those in which the vine vegetables — cucumbers, summer squash, and muskmelons — are planted. These should be three feet from the rows nearest them. The Hubbard squash can be planted with the seed corn. Cucumbers, summer squash, and muskmelons would best be placed near the south side of the garden because they are low growing. With this in mind we begin at the south edge of the plan, measure off three feet to the north, and mark a row for the vines and three feet more to the first row on the other side of them. From there we leave two and one half feet between every two rows. This gives us ten rows north of the vines. The last row is but one and one half feet from the north edge of the garden. This will be satisfactory, however, because it will be planted to sweet corn (the tallest vegetable), and we shall be careful to cultivate thoroughly on the north side of the row.

Now let us look over our list of vegetables. We find that some seeds can be sown early in spring, that others must not be sown until after all danger of frost is past, and that still others must be started in the house and the growing plants set in the garden later. The early seeds are beets, carrots, lettuce, onions, parsnips, peas, radishes, and early turnips. Since none of these is tall growing, they can be planted on the southern half of the garden. We remember that one of these vegetables, parsnips, is treated differently from the others in that it is left in the ground and dug during the winter. Since we are going to clean up our garden plot in the fall and should not like to have a row left somewhere in the middle, we place the parsnips on the very southern edge of the garden.

The vine vegetables will not be planted so early as will those in the first list, but we must calculate how many hills we wish to have, knowing that they must be three feet apart. We decide that four hills of muskmelons and three hills each of summer squash and cucumbers will be enough, and we therefore mark these off on the row beginning at the east end. We find that this leaves about eighteen feet on the west end, which can well be used for a first sowing of radishes and lettuce, and, after they are gone, for some late hills of cucumbers for pickles.

Now we are ready for the first of the regular rows. The amount of seed for each vegetable planted will depend on our own choice in the matter, but the earliest vegetables should be planted in the most southern row and the planting continued northward. We shall decide on one row of peas, one of onions, one of carrots, and a half row each of early turnips and beets. This completes the first group of vegetables, and leaves all the ground to the north unoccupied and in good shape to be raked over occasionally so as to kill weeds and preserve moisture before sowing the second group of seeds, which must be planted after all danger of frost is over. They include the vine vegetables, sweet corn, and beans. The young plants from tomato, cabbage, and parsley seed sown in the house, will be ready to set out in the second group. We need only a few plants of parsley and, since they grow the entire season, they might well be


N
E
W
S
Sweet corn (first planting)
Sweet corn (second planting) and nine hills of Hubbard squash
Tomatoes
Snap beans (first planting) followed by late radishes and lettuce
Lima beans
Early cabbage followed by late turnips
Radishes and lettuce (second planting) followed by late turnips
Peas (second planting) followed by late cabbage
Early turnips followed by late beets
Early beets
Carrots
Onions
Peas (first planting) followed by half row each of late beets and snap beans (second planting)
Radishes and lettuce (first planting) followed by five hills of late cucumbers
Cucumbers
Summer squash
Muskmelons
Parsley
Parsnips
Scale 1/8 in. = 1 ft
Group I
Group II

Plan for the home vegetable garden

placed in the parsnip row at the south side of the garden. We must provide for two plantings of sweet corn. The Hubbard squash can be sown in the second planting. We ought to have a second sowing of peas and some more radishes and lettuce. Keeping all these things in mind and beginning next the northern row in Group I, we may indicate on our plan a row of peas for a second planting; a half row of early cabbage plants; a half row of radishes and lettuce for a second planting; a half row of snap beans; a half row of Lima beans; a row of tomato plants; and two rows of corn. These and the cucumbers, summer squash, and muskmelons can all be sown about the same time after all danger of frost is over, except the second planting of corn and the Hubbard squash, which, of course, should be a week or two later than the first planting of corn in the outside row.

This completes the garden for early summer. It is quite possible, however, that many of the vegetables will be through bearing about the first of July, and we can fill their places with late vegetables for winter. Beginning at the southern side of the garden, we look over the plan and decide which ones may be replaced and with what we shall replace them. In actual practice our plan may not work out in all cases because of a backward season or for some other reason, but it is well to be prepared and no ground should lie idle if we can help it. We have already said that the first sowing of radishes and lettuce will be followed by some late cucumbers for pickles, and this completes the vine row. The first peas will come out, and in their place we may sow a second planting of snap beans and some late beets. Onions and carrots should remain. The half row of early turnips should be used in time to be replaced by some more late beets. The early beets will probably need to remain. The second planting of peas should be through yielding in time for a row of late cabbage plants that have been raised in a box. The early cabbage and the second planting of radishes and lettuce will be past their best period in time to be replaced with a row of late turnips. The Lima beans will remain, but the first planting of snap beans will have been used and that half row can be replaced by fall radishes and lettuce. These should be planted in August after the hottest part of the season is past. The tomatoes and corn will, of course, remain.

If all goes well, we should have a good variety of vegetables to store over winter: parsnips, cucumbers for pickles, beets, onions, carrots, dry shelled snap beans, cabbage, turnips, and Hubbard squash.

So we have the plan complete, and measuring with our scale we can determine how many feet of row or how many hills of each vegetable there will be. Looking, then, at the offers of the seedsmen on pages 1233 and 1234, we can determine how many packets of seed we shall need and what they will cost. It is always wise to buy a little more seed than will be needed. It will be well to make out the seed order and send it off at once.

The garden plan, which we have given in order that you may see how to prepare your own plan, will serve merely as a guide. Each boy and girl who is going to have a garden, should sit down and work out his or her plan in the same way whether the garden is large or small. The garden of thirty by fifty feet is a good size for an active boy or girl twelve years of age and upwards, although you remember that Stanley Benham, whose letters were in the January leaflet, had a garden about four times as large as this. If you are younger than twelve years, perhaps it would not be wise to undertake such a large garden. For a smaller plot of ground, fewer vegetables would better be grown. A boy or girl even eight or nine years old can take care of a strip of ground ten by fifteen feet and grow a crop of radishes and lettuce, or cabbage, tomatoes, sweet corn, or any one or two of the vegetables that the family will enjoy.

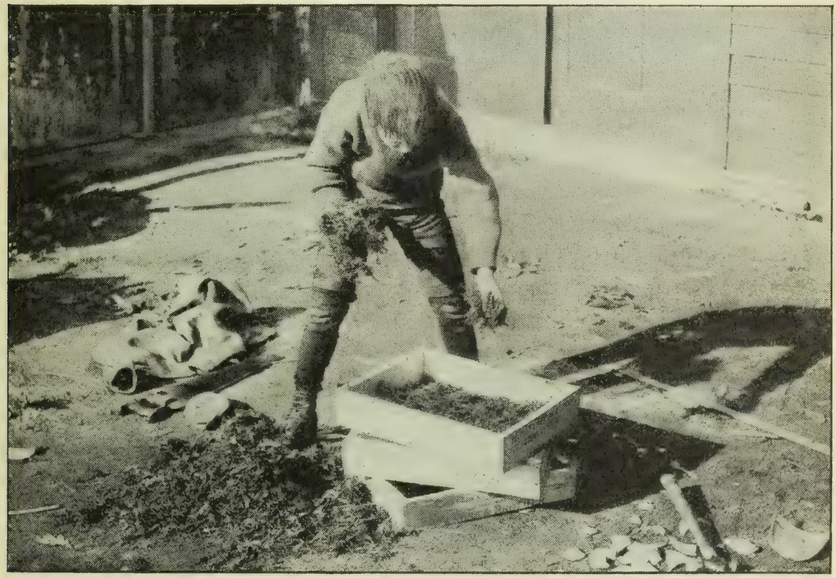
Now let us suppose that your garden plan is complete and that you have sent for the seeds that will be needed. For plants that should be started indoors, you can prepare the boxes, or "flats," before the seeds come. Early cabbage and tomato plants and a few plants of parsley are all that it is necessary to start in this way, but, if you choose, you may also start cucumber, squash, or lettuce. Find or make shallow boxes, three or four inches deep and a foot or more square, and bore holes in the bottom for drainage. Next the bottom place a layer of coarse spongy material, such as moss, sawdust, or coarse manure. On top of this, place very fine rich soil and take pains to have this soil right. You can make a screen out of some wire netting and use it to sift the soil. As the soil is put into the box, pack it down firmly. When the box is full to within a half inch of the top, it is ready for the seed. Use one box for each kind of vegetable. Do not sow the seed until about six weeks before it is time to plant outdoors. At one side make a straight furrow in the soil and sow a row of seed. Sow two or three rows if you think they will be needed. Cover the seed with finely sifted soil from a quarter to a half inch deep, and firm gently. Save the rest of the box so that the plants may be transplanted into it after they are well started. This transplanting process is called " pricking out " and simply means that you take the tiny plants (about an inch high) and set them in a new place, an inch or two apart. Be very careful to do this without injury to the plants, and be sure to press the soil firmly around them. Then they will have room enough to grow until you are ready to set them out of doors in the garden. A south window in the kitchen is a good place to set the flats, which should be kept moist.

While the plants are starting indoors, you will be watching the outdoor garden plot each day; and finally it will be dry enough so that it can be worked. Begin at once. If the ground was plowed last fall it has been broken and crumbled by the freezing and thawing of winter and can be put into shape quickly. If spring plowing must be done, cover the ground with a good coating of barnyard manure. The labor of plowing or spading the ground is always the heaviest part of the work and often is discouraging. If you show your father or big brother that you are in earnest about the garden and mean to make it worth while, you will surely have help with this part of it. After the soil is turned over, begin to level it and to make it fine with a rake or a harrow. One of the secrets of a good garden is to have the soil in the best possible condition before the seeds are sown. Moreover, it is very much easier to work when there are no young plants to avoid. Perhaps there will be several weeks between the time you plow and the time when it will be safe to sow some of the seeds. Certainly this will be true of the seeds included in Group II. Meanwhile there is opportunity to kill two or three crops of weeds by letting them sprout and then raking the garden over. Every weed killed before planting means less trouble afterward. Work faithfully in order to obtain a good seed bed — one that is fine, firm, moist, warm, and free from weeds.

A home garden

It would be impossible to give exact dates for planting the seeds. The time will vary with the kind of seed, with the season, and also with the location. There is considerable difference in temperature between southern New York, on Long Island for example, and St. Lawrence county in the northern regions. You will have to develop judgment about planting. Those seeds that may be hurt by frost should not be planted until all danger is past.

Sow the seeds according to the plan you have made, measuring distances carefully and making the rows straight and even. It is always well to use a garden line as a guide. Be careful not to sow the seed so thickly that you fail to cover the space allotted. Tiny seeds slip between the fingers easily and are gone before you realize it. Guard against this mistake. Sow the seed as evenly as possible, and cover it to the required depth, firming the soil well. The best garden is not all sown in one day and then left for a couple of weeks until plants and weeds have sprouted. Each vegetable is studied and sown at the best time for its development. Often, however, it is not practicable to do this, and then certain seeds can be grouped as indicated on our plan. Boys and girls who have opportunity to visit their gardens daily will find much success and pleasure in treating each vegetable by itself and studying its peculiar needs.



Preparing the flats

Care of the garden should be constant and thorough. Not a day should go by that does not find you in the garden for a time doing those things that need to be done. " A stitch in time saves nine," and often a few hours or a day will make all the difference between success and failure. One of the most important matters is that of thinning. It hardly seems right at the time to thin a row of fine little beet or turnip plants and pull out most of them leaving only the strongest plants six inches apart. Later on, however, you will realize that the plants which were left have grown better and more rapidly because they have had room and they will be tender in quality and fine in flavor because they were not stunted.

There are often vacant places in the garden that can be used by setting in a lettuce, a tomato, or a cabbage plant. Do not leave such places unfilled. Transplanting is not a difficult process although many persons are not successful because they are not careful. Good gardeners are able to transplant almost any plant. It should be done late in the afternoon and, if possible, while the soil is moist after a rain. The plants should be well soaked before they are dug up in order that plenty of soil will cling to their roots. Dig a hole in the proper place, larger and slightly deeper than the roots of the plant, and set the plant in the hole. Cover the roots with soil, and press it firmly around them; fill in more soil, pressing it down now and then, until the level of the ground is reached. The secret of the operation is to transfer the plant to a new place without exposing the roots to the air for any length of time, and to see that they are closely covered when reset.

Cultivation, or the stirring of the soil, has two functions; it kills weeds and helps to hold moisture in the soil. Weeds should never be allowed to get a start. Natural moisture is better than water put on with a hose or from a watering pot. Any loose material lying on the surface of the soil will prevent the moisture from evaporating in the heat of the summer sun. You can make the top layer of soil act as the protective covering by keeping it loose and crumbly. After each rain, as soon as the soil can be stirred, take a rake and break up the surface soil. This will soon dry out and, to one who does not know, will seem too dry. But if this layer of an inch or more of dry soil is brushed off, firm, moist soil will be found underneath and it will remain moist even during a long drought. So, whether there are weeds or not, you should cultivate whenever the surface becomes packed in order that at all times the surface soil, or " soil mulch," as it is called, may protect the under soil and save moisture.

If watering becomes necessary, do it thoroughly. Do not sprinkle the surface and leave it, for the moisture will evaporate in no time and leave the soil baked. Soak the ground well, and as soon as the surface begins to dry stir it into a mulch as you would after a rain.

There will be injurious insects and diseases in the garden; but the better kept the garden is, and the healthier the plants are, the less the danger will be. If the trouble is serious, find out what causes it and ask some one who can help you, what to do to control it.

In the fall the garden plot should be cleared and left in good condition for the winter. All vegetables that are usable should be carefully harvested and stored where they will keep. The vines and the plants should be pulled and piled, the sweet corn should be cut and shocked, and the garden should be cultivated and raked until it is free from weeds, and in good order. If the soil is heavy, plow or spade in the fall.

All that is written here, and much more that might be written, is of little value compared to your own personal study and care of the garden. There are a few general rules for gardening, but there are, in addition, hundreds of detailed practices that will come to one who watches intelligently and who loves to make things grow vigorously and well. The rules we have tried to give; the details you must find out for yourselves. If you have a garden that is truly worth while this summer, if you plan it thoughtfully, and care for it faithfully, you will find one of the real pleasures of life and, in years to come, no spring will approach without finding you making plans, and no summer will pass without your presence in a garden, and each garden will be better than the last. To sum up, a successful vegetable garden depends on the following considerations:

1. *A well-thought-out plan.*
2. *Good seed.*
3. *Thorough preparation of the soil.*
4. *Careful sowing and transplanting.*
5. *Proper thinning.*
6. *Constant cultivation.*
7. *The soil mulch.*
8. *Control of pests — weeds, insects, diseases.*
9. *Watchfulness, study, care.*

Farm helpers

TIME OF SOWING

C. E. Hunn

The following statement will be found helpful as a general guide for sowing seeds:

1. *Flower seeds that may be sown as soon as the ground is fit to be worked in the spring:* alyssum, bachelor's-button, calliopsis, candytuft, four-o'clock, marigold, mignonette, morning-glory, nasturtium, pansy, phlox, pinks, poppy, scabiosa, sweet peas, verbena, zinnia.

2. *Flower seeds that should be sown after danger of frost is over. The best results are obtained if the plants are started in the house in April and are set out after the tenth of May:* aster, balsam, cockscomb, larkspur, petunia, sunflower.

3. *Vegetable seeds that should be started indoors:* early cabbage, parsley, tomato.

4. *Vegetable seeds that may be sown as soon as the ground is fit to work in the spring:* beet, carrot, lettuce, onion, parsnip, peas, radish, spinach, turnip.

5. *Vegetable seeds that should not be sown until the ground is warm and all danger of frost is over:* beans, corn, cucumbers, muskmelon, squash, watermelon.

DEPTH OF SOWING

C. E. Hunn

The following statement will be found helpful in planting seeds:

1. *Flower seeds that should be planted not over one half inch deep:* alyssum, balsam, candytuft, cockscomb, four-o'clock, larkspur, mignonette, morning-glory, pansy, petunia, poppy, scabiosa.

2. *Flower seeds that should be planted one inch deep:* aster, bachelor's-button, calliopsis, marigold, phlox, pinks, verbena, zinnia.

3. *Flower seeds that should be planted two inches deep:* nasturtium, sunflower, sweet peas.

4. *Vegetable seeds that should be planted one half inch deep:* cabbage, carrot, cucumber, lettuce, muskmelon, onion, parsley, radish, tomato, turnip.

5. *Vegetable seeds that should be planted one inch deep:* parsnip, pumpkin, spinach, squash, watermelon.

6. *Vegetable seeds that should be planted one and one half inches deep:* beet.

7. *Vegetable seeds that should be planted two inches deep:* beans, corn, peas.

THINNING AND TRANSPLANTING

C. E. HUNN

In order to have a good garden, each plant should have room for its fullest development, and since most of the seeds of garden flowers and vegetables are small it is almost impossible to sow the seeds sparsely enough so that each plant will grow to perfection. Since this is the case, the plants must be thinned, and either thrown away or transplanted to some other part of the garden. If the thinning is done in cool, cloudy weather, the seedlings may be transplanted with great ease; but if it is done in dry, sunny weather, the seedlings must be shaded after being set out. It is best to thin the plants when they are small, before they have become crowded, but if one wishes to save them for transplanting they may be left until they are large enough to handle. The following statement will be found helpful to young gardeners in thinning and transplanting:

1. *Flowers that should be four inches apart:* alyssum, balsam, candytuft, poppy.

2. *Flowers that should be six to eight inches apart:* bachelor's-button, dianthus, four-o'clock, mignonette, morning-glory, pansy, phlox, sweet peas.

3. *Flowers that should be planted twelve inches apart:* aster, calliopsis, cockscomb, larkspur, marigold, nasturtium, petunia, scabiosa, verbena, zinnia.

4. *Flowers that should be eighteen to twenty-four inches apart:* sunflower.

5. *Vegetables that should be six inches apart:* beet, lettuce, parsnip, parsley, spinach, turnip.

6. *Vegetables that should be twelve inches apart:* snap beans, cabbage.

7. *Vegetables that may be sown thickly:* carrot, onion, pea, radish.

8. *Vegetables that should be two to three feet apart each way:* corn, Lima beans, tomato.

9. *Vegetables that should be three to five feet apart each way:* cucumber, muskmelon, pumpkin, squash, watermelon.

PHOTO BY VERNE MORTON

Friends of the gardeners?

SEEDS FOR CHILDREN'S GARDENS

OFFER MADE BY W. Atlee Burpee & Co.,
Philadelphia, Pa.

PRICES: Two cents per packet — postage prepaid.
No order for less than twenty-five cents for twelve packets.
(Special rate — If teachers will send an order for the school and distribute packets to the children, the price will be $1.40 per hundred packets. Express collect.)

SENDER: Any boy or girl may send directly for twelve or more packets.
Parents may send for seed for their children.
Teachers may send for packets for the school as indicated in the special rate above.

Number of packets desired	One packet will sow	Flowers	Number of packets desired	One packet will sow	Vegetables
	If seed is carefully used, one packet will sow ten to fifteen feet of row	Alyssum		15 feet	Beans, bush Lima
		Aster		15 feet	Beans, snap
		Balsam		10 feet	Beet
		Celosia (cockscomb)		200 plants	Cabbage, early or late
		Centauria (bachelor's-button)		15 feet	Carrot
		Dianthus (pinks)		15 feet	Corn, pop
		Larkspur		25 hills	Corn, sweet
		Marigold		18 hills	Cucumber
		Mignonette		20 feet	Lettuce
		Morning-glory		18 hills	Muskmelon
		Nasturtium (climbing)		10 feet	Onion
		Nasturtium (dwarf)		15 feet	Parsley
		Pansy		20 feet	Parsnip
		Phlox		15 feet	Peas
		Poppy		10 hills	Pumpkin
		Scabiosa (mourning bride)		10 feet	Radish
		Sunflower		25 feet	Spinach
		Sweet peas		10 hills	Squash, early
		Verbena		10 hills	Squash, Hubbard
		Zinnia		175 plants	Tomato
				20 feet	Turnip, early or late
				12 hills	Watermelon

W. Atlee Burpee & Co., Philadelphia, Pa.

Date,.................................., 1914

For enclosed remittance of..............................you will please forward promptly, postpaid, the..............................packets of seeds indicated above.

(Special rate to teachers. For enclosed remittance of..............................you will please forward promptly, express collect, the..............................packets of seeds indicated above)

Name.. { Child, age............
Parent
Teacher

Street address or box number,..

Postoffice,..R. D. Route..

County,..State,..

Order blank from Cornell Rural School Leaflet

SEEDS FOR CHILDREN'S GARDENS

OFFER MADE BY James Vick's Sons,
189 Main St. East, or 18–20 Stone St.,
Rochester, New York.

PRICES: Two cents per package — postage prepaid.
No order for less than twenty-five cents for twelve packets.
(Special rate. One hundred packets for $1.75, postage prepaid.)

SENDER: All orders must be sent through the teacher.

Number of packets desired	One packet will sow	Flowers	Number of packets desired	One packet will sow	Vegetables
	If seed is carefully used, one packet will sow ten to fifteen feet of row	Alyssum		10 feet	Beets
		Aster (our own famous strain)		300 plants	Cabbage
		Bachelor's-button		15 feet	Carrot
		Calliopsis		15 hills	Corn, sweet
		Candytuft		9 hills	Cucumber
		Dianthus (pinks)		20 feet	Lettuce
		Four-o'clock		12 hills	Muskmelon
		Marigold		10 feet	Onion
		Mignonette		15 feet	Parsley
		Morning-glory		20 feet	Parsnip
		Nasturtium (climbing)		10 feet	Peas
		Nasturtium (dwarf)		12 hills	Pumpkin
		Pansy		10 feet	Radish
		Petunia		25 feet	Spinach
		Phlox		12 hills	Squash, early
		Poppy		12 hills	Squash, Hubbard
		Scabiosa (mourning bride)		100 plants	Tomato
		Sweet peas		20 feet	Turnip
		Zinnia		12 hills	Watermelon

James Vick's Sons, Rochester, New York

Date.., 1914

Enclosed find..............................to cover cost of the..............................packets of seeds indicated above.

Postoffice,..

State,..

School No..........................Grade.......................................

Teacher's Name,...

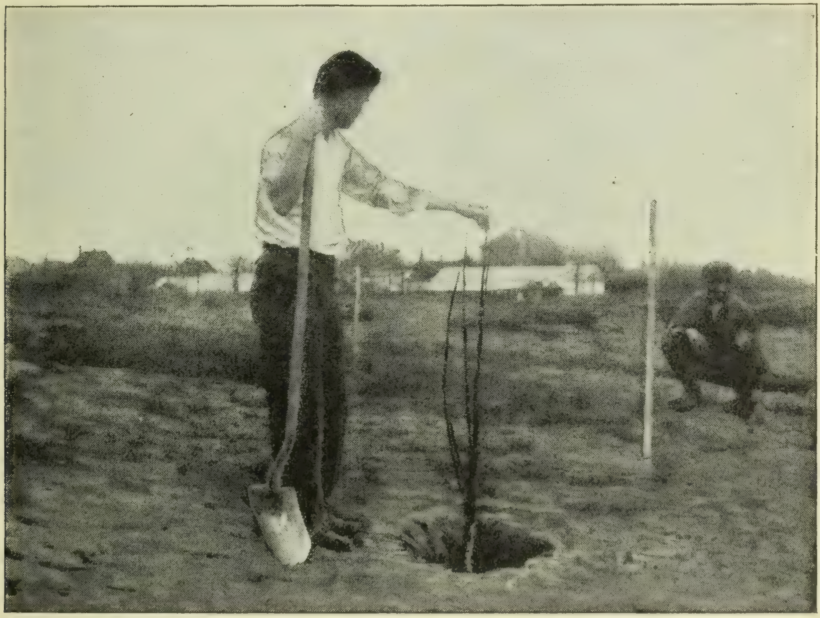
Order blank from Cornell Rural School Leaflet

THE SCHOOL GROUNDS

Have you taken a careful look around the school grounds as was suggested in the January leaflet? If so, you have in mind what you are going to do this spring in order to make the school yard more attractive. The following helps may prove useful:

PLANTING TREES OR SHRUBS

Read the letter on page 1198, which gives a list of wild shrubs that may be used around the school building. Young trees can also be found in the woods. Maples, oaks, and elms will be among the best. A young fruit tree, if one can be obtained, is very desirable in the right place on the school ground.



The tree is ready for the filling of the hole

In planting remember a few simple rules:

1. Plant before the leaves appear in the spring.

2. Do not dig up the tree or shrub until you are ready to reset it, and never allow the roots to dry out between digging and setting.

3. Dig carefully and retain a good supply of roots. Trim off broken or split roots, leaving the ends with a clean, sharp cut surface.

4. Make the hole large enough to receive the roots without crowding, and deep enough to set the tree or shrub about two inches lower than it originally grew.

5. In digging, keep the rich surface soil in a separate pile and after the hole is dug, throw some of this rich soil into the bottom; it is better for roots than is the subsoil. It is often a good plan to throw in a pail of water. Do not put manure or fertilizer into the hole.

6. Set the tree or shrub in the hole and arrange the roots carefully, keeping the stem upright.

7. Throw in a little soil and work it around and between the roots with your fingers, so as to be sure that there are no air spaces left.

8. Throw in more soil and firm it carefully around the roots until they are covered. Then fill the hole, firming the soil constantly. The earth around the tree should be left dished so as to catch the rainfall, and the surface should be loose in order to prevent the loss of moisture.

9. Prune the top of the tree or shrub in order to balance the loss of roots. This operation is necessary and must not be neglected because the reset roots are not able to supply food for as many branches as there formerly were. Thin out from one third to one half of the branches, leaving the strongest ones to form the framework of the tree.

10. Protect the newly set tree or shrub from injury. If the weather is dry, water it thoroughly.

PRUNING

As in the case of transplanting, pruning should be done before the leaves start in the spring. On the school ground the only pruning necessary will be on fruit trees or on shrubs that have grown ragged and unshapely. Pruning is interesting work because by means of it a tree can be trained into a desirable shape. Remember these few rules:

1. Use a sharp knife that will make a clean straight cut. For larger limbs use a small saw, and finish off the roughest edges with a knife.

2. Remove any limb or twig that is growing across another and that, if left, would rub and injure the bark. In deciding between two crossed limbs leave the stronger one or the one that keeps the shape of the tree most perfectly.

3. Always cut off a limb close to the branch from which it grew so that the bark will soon grow over the cut surface. Never leave a short stub end.

4. Do not have too many branches coming from the trunk of the tree. Four or five are plenty, and will make an open tree that will allow the sunlight to enter.

5. In pruning smaller branches and twigs, always cut just above a strong leaf bud. The bud will probably grow into a branch and should therefore be on the side toward which you want the branch to grow. By choosing these buds carefully, the tree can be trained as desired.

6. Prune out all dead wood.

7. Prune off all young shoots that come from large branches or the tree trunk. These are called "suckers." They waste the strength of the tree without making desirable growth.

8. In pruning shrubs, cut out dead wood and trim the shoots back somewhat into a well-shaped and compact clump, always cutting above a bud.

GRAFTING

If there is a wild fruit tree on the school grounds perhaps it will be possible to graft it over to a good variety. Do not attempt this work, however, unless some older person in the neighborhood will show you how, and will lend you the tools and grafting wax. Grafting consists in setting a twig of a good variety into the branch of another tree in such a way that the twig will take hold and grow. The twig is called the "scion," and the tree is called the "stock." Between the hard wood and the bark of a tree there is a layer of tissue which is alive and growing. This is called the "cambium layer." In order that a graft may grow, the cambium layer of the scion must touch the cambium layer of the stock. The different methods of grafting all do this. The following descriptions of whip grafting, cleft grafting, and the making of grafting waxes and bindings were written by Mr. R. D. Anthony and published in a teachers' leaflet some years ago.

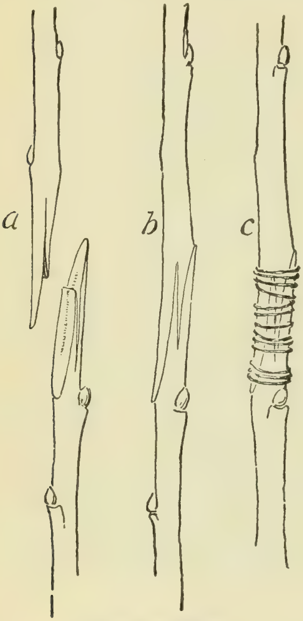
Ready for work on the school grounds. A school in Cortland county

Whip grafting.— The fruit-grower may use whip grafting to top-work a two-year-old or three-year-old tree when the branches are not too large to be cut easily. In such a case, the work is done just before growth starts in the spring.

A branch that grew the previous year is chosen for the scion, and the lower and the upper parts, which have poorly formed buds, are discarded. The lower end of the part remaining is cut off with a smooth diagonal cut at such an angle that the cut is three quarters to one inch long. The knife blade is then placed squarely across the cut surface a little above the center, and a thin tongue, about half an inch long, is raised up by rocking the knife slowly into the wood. The scion is then cut off so that it contains three buds, the cut being made just above the third bud.

The top of the stock is prepared in the same way as is the base of the scion. The two are then placed together so that the tongue of one fits into the cut of the other. If the two are of the same size, the cambium layers can be placed together on both sides of the tongues; but if one is smaller than the other, the cambium layers are placed together on one side only. The graft is then wound with waxed darning cotton.

Frequently in the west, and occasionally in the east, the nurseryman obtains his apple varieties by whip grafting the scion on a piece of apple seedling root about three to six inches long. The grafting is done in the winter or early spring.

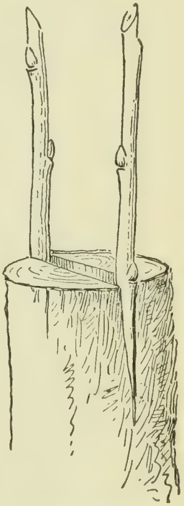


Whip grafting

Cleft grafting.— When a tree is five or six years old and comes into bearing, the grower sometimes finds that the variety is not what he wants and he wishes to top-work the tree to the desired variety. The tree is too large for whip grafting and so cleft grafting is practiced. In early spring before the buds start, a branch is sawed off, care being taken that the bark is not ripped down when the branch breaks over. The stub is then split down two or three inches through the center with a grafting chisel or heavy knife. A one-year-old branch of a good variety is used for the scion and the base is cut off about an inch below a well-matured bud. Two straight cuts are made, starting on either side of this bud and coming out at the bottom in such a way that the base is wedge-shaped from the bud downward, and is somewhat thicker on the outer, or bud, side. This wedge should be nearly the same shape as is the split in the stock. The scion is then cut off just above the third bud from the bottom.

With the narrow wedge on the grafting chisel, or with a wedge-shaped piece of wood, the cleft on the stock, or stub, is forced open and the scion is inserted so that its outside cambium is in contact with the cambium of the stock at one side of the cleft. In order to insure this contact, the top of the scion is tipped out a little so that the two cambiums will cross each other. A second scion is prepared and inserted in like manner on the other side of the cleft. When the wedge is removed the cleft should close and grip the scions firmly. Since the scion wedges are thickest on the outside, the contact will be firmest where we have placed the cambiums in contact; and at this point growth should start. The entire cleft and all cut surfaces are covered with a good grafting wax.

Directions for making grafting waxes and bindings.— In order to make common resin wax, place in an agate kettle one pound of resin, one half pound of beeswax, and one quarter pound of rendered tallow, which is obtained by melting beef or mutton tallow and allowing it to cool. Melt these three ingredients, being careful that the mixture does not boil. When they are completely melted, take the kettle from the fire and pour the hot liquid into a pail of cold water. Grease the hands thoroughly, and flatten the spongy mass beneath the water so that it will cool uniformly. It is important that it should be removed from the water when it is cold and tough, but not brittle. After it has been taken from the water, pull it as you would molasses candy until it is ductile and fine-grained. If it is lumpy, remelt and pull again. Make the finished wax into balls or small skeins and put them in a cool place, laying them on greased paper so as to avoid sticking.



Cleft grafting

Alcoholic wax is made from a pound of white resin, an ounce of beef tallow, a tablespoonful of turpentine, and five ounces of alcohol. Melt the resin slowly and when it is completely melted add the beef tallow. Remove the kettle from the fire, and add the turpentine and alcohol slowly, stirring constantly. When finished, this wax is a thick paste and should be kept in bottles or cans.

Waxed string for binding small grafts is made by dipping a ball of No. 18 knitting cotton into the kettle of melted resin wax before it is removed from the fire. Leave the ball in the wax for a few minutes, turning it frequently so that it will be thoroughly saturated. After removing it allow it to drain and dry.

Waxed bandage is made in the same manner as the waxed string. A roll of bandage or cloth should be used in place of the string.

THE LETTER BOX

Every day some boy or girl in your school makes a discovery on the farm or along the wayside that we should like to hear about. We should also like to know of all new plans that you may be making. For this reason we want you to make a letter box for the schoolroom, and to put into it letters for Mr. Tuttle whenever you have learned something new or when you have started an experiment of any kind. When the box is filled, perhaps your teacher will mail the contents to us. Remember that every communication will be read even if each letter is not answered personally. Always be sure to give your district number and township.

What will you write about? Anything that is interesting to you will be of interest to us. Perhaps some of the subjects will be as follows:

1. How you ordered your garden seeds.
2. Arbor Day. What you planted. How you celebrated the day.
3. What you have done this year to make the school grounds more attractive.
4. Whether you have ever had a play at your school.
5. The new birds you have learned to recognize.
6. The trees in your neighborhood.
7. What quotations you have learned from this leaflet.
8. Your school garden.
9. Your home garden.
10. The correspondence you are carrying on with some other school about the ear of corn you sent to the College for Farmers' Week.
11. Your plans for Corn Day next fall.
12. The piece of work you are to do during the summer.
13. A trip that the school took to the woods.
14. The names of the wild flowers that you know.
15. The names of garden plants that you have grown.
16. The number of grains you have seen growing.
17. The number of different field crops of value in your district.
18. Something about the most persistent weed in your neighborhood.
19. The flock of hens that you are caring for.
20. The persons who have visited the school this year, and what you learned from them.
21. What book you are reading.
22. What you like best in this leaflet.

FOLLOW THE CORN

When this leaflet reaches you, Farmers' Week and the Corn Exhibition will be over. About nine hundred schools sent in ears of flint and dent corn, selected last Corn Day.

Perhaps your school won a prize for the best ear of either type in your county. If so, the corn has been returned to you with directions for storage, planting, cultivation, harvesting, and seed selection next fall. Do not lose this opportunity. One of the older boys will be glad to plant the seed from the ear of corn, and to follow the directions given. There may be a place on the school ground where the planting can be done, and each girl and boy in the school should be interested in the result and should help in some way to make it a success. The product from the ear should be a finer grade of corn than is the usual grade. From it a more perfect ear can be chosen for Corn Day and Farmers' Week next year, and the remainder can be given away or sold by the school to farmers in the district who desire good seed.

Perhaps your school sent an ear of corn for Farmers' Week but did not receive a prize this year. One of the visitors at the exhibit may have liked the ear and taken it home for seed. He then agreed to write to your teacher and let her know where the corn was, and also to tell the school in his own district from what school the corn came. If you receive a letter from a farmer or from a school with news of your ear of corn, do not fail to answer it. Keep a permanent record of the name and address of the farmer who has the corn, and of some member of the school in his district to whom a letter can always be sent. Be sure to give these persons the address of some one in your own school who will always be on hand to receive a letter. Unless your teacher is certain to remain with you next year, one of the older boys or girls would better do the corresponding for the school because the address given to the other school should be a permanent one.

If a farmer in your district tells your school that he has been to Farmers' Week and brought home an ear of corn that was chosen by another school, do not fail to obtain the name and address of the teacher in that school and send a first letter saying that you will follow the growing of the corn from the ear that they selected, and will keep them informed of its progress. Send the name and address of a permanent member of your school and ask for a similar address from the other school.

Girls and boys, here is an opportunity to make Corn Day and Farmers' Week count for real things. The corn that you selected has gone back to the farms to produce a better crop. Whether it has gone back to your own locality or to some other is not so important. The important point is that you selected a good seed ear which some one is using to improve his crop. There will be all the pleasure and profit of writing to another school and to the farmer who has the corn, and of having replies from them. You will be in touch with persons in another part of the State, with other girls and boys and older folk. This is very worth while, and you will not let such an opportunity pass for lack of a letter on your side. Follow the history of the ear of corn as long as you can.

Do not be discouraged if the ear of corn you sent to Farmers' Week this year was not taken home by any one. Make greater effort to select a fine ear next year, and you will be successful. Let us make Corn Day a strong factor in the improvement of the corn crop in New York State.

Cornell Rural School Leaflet

FOR TEACHERS

Published by the Department of Rural Education, New York State College of Agriculture at Cornell University. W. A. Stocking, jr., Acting Director. Entered as second-class matter, Ithaca, New York

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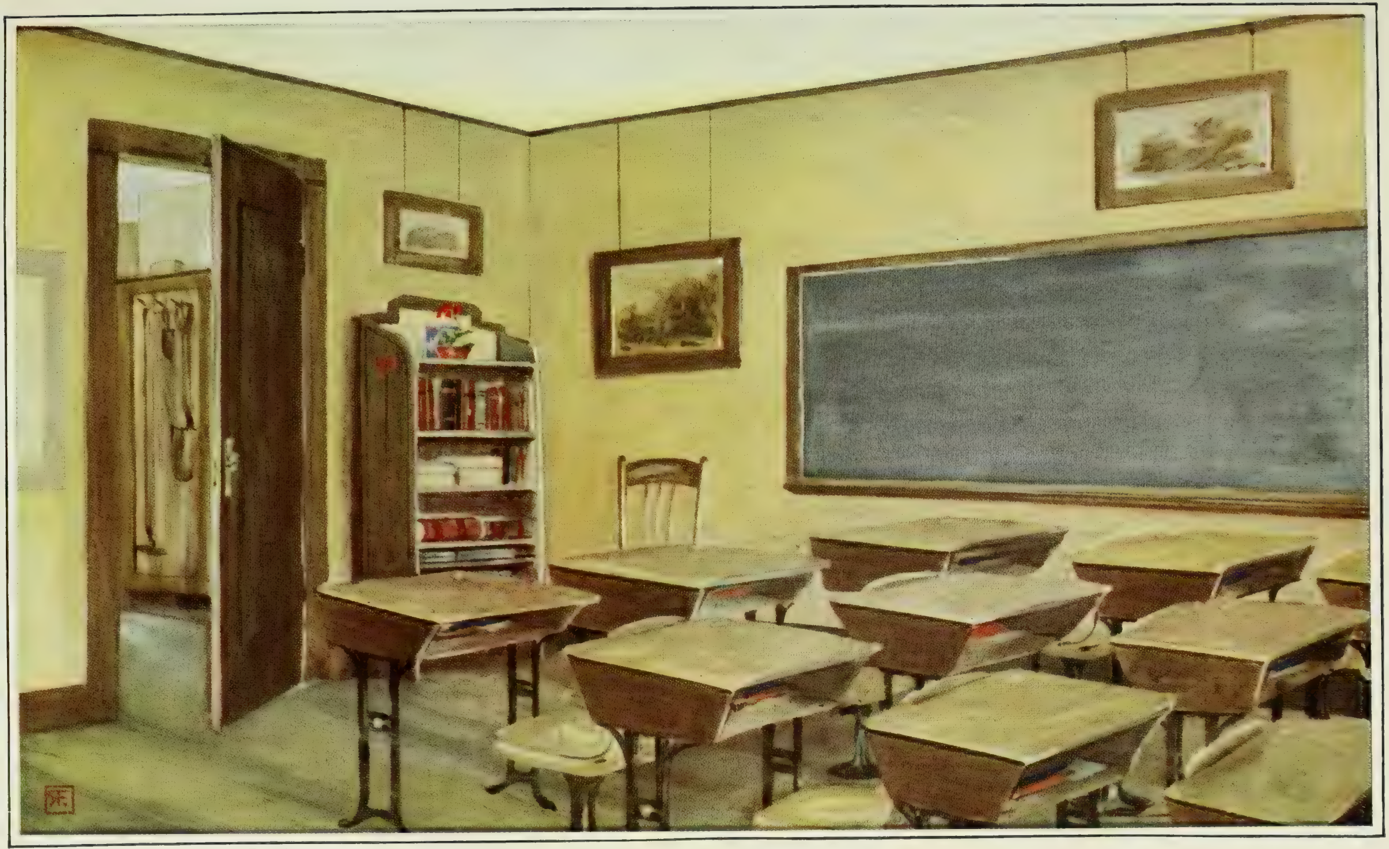
DECORATION FOR THE RURAL SCHOOL

Royal B. Farnum
(*The University of the State of New York*)

Castle Gondolpho
by
Corot

EDITORS' NOTE

To the courtesy of Mr. Royal B. Farnum, of the University of the State of New York, we are indebted for the work in this publication. We believe that the suggestions for the improvement of rural schoolrooms will be read carefully, and that one or more of them will be followed by our rural teachers. We shall be glad to know how any changes have been made in the different schools, and shall therefore ask the teachers to tell us of their efforts and the results. We shall publish an account of some successful experiences in the improvement of rural school buildings, and this may be the means of encouraging other teachers to try similar improvements. We hope to hear about each accomplishment, however small.



Color Drawing by Royal B. Farnum

COLOR SKETCH SHOWING THE SHADOW CORNER OF A ROOM, WITH INTEREST FOCUSED BY MEANS OF MORE INTENSE COLOR AND A BIT OF NATURE.

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DECORATION FOR THE RURAL SCHOOL

The growth in the general character of the rural school has been steady and constant for the past ten years or more. The exterior of buildings and the school grounds have received some attention, but except in special instances the beauty of the interior has been woefully neglected. This may be due to a number of causes. The average boy or girl in the country begins earlier in life the real work of making a living than does the average city boy or girl. The manual duties on the farm, a motor training that the city school is doing its utmost to cultivate for the city child, begin at a very early age and lead the child's thoughts away from an attitude of reflection and the enjoyment of beautiful things. There is, therefore, all the more reason why an art background should receive consideration in the rural school.

Furthermore, a life on the farm demands that the greater part of the man's time be spent out of doors, and the beauty of an interior is usually left to the overworked housewife. Thus, with a one-sided interest in such matters, the men, who usually constitute the school board, too often see no value or enjoyment in such " fancies " as schoolroom decoration. And yet, with interests both material and commercial, there are few men who do not enjoy and actually seek some kind of real beauty. They are made so that their natures demand it.

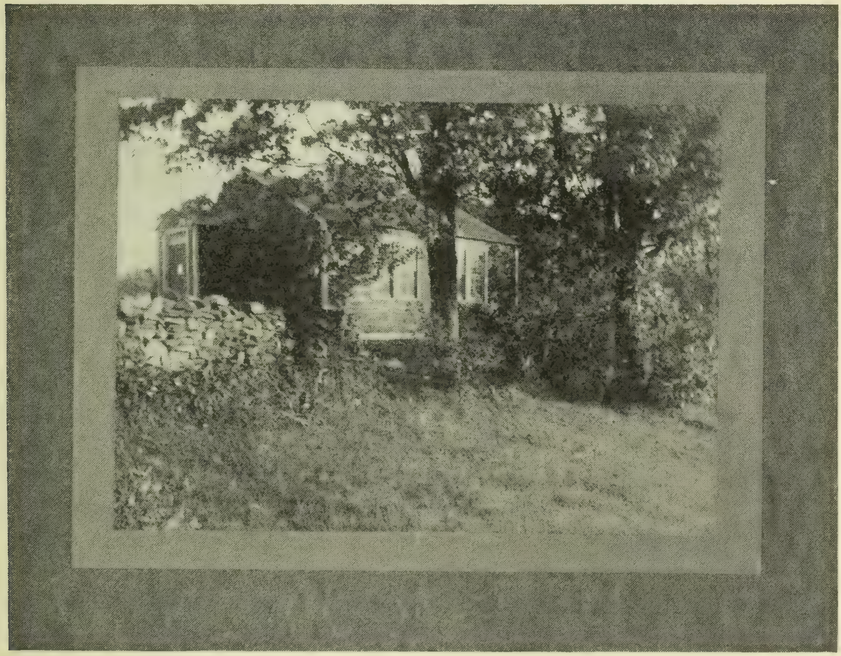
A natural place for the revelation of beauty is in the schoolroom, where the pupil may become familiar with beautiful forms. Familiarity with the beautiful and an understanding of the principles underlying it will do much to develop a love for it. Valuable lessons are likely to be lost, however, unless the schoolroom serves as a concrete example of the principles on which the study of beauty is based.

THE ROOM

Other persons have written about the use of water, soap, and the scrubbing brush. Naturally, a thorough cleansing of a room is essential as a preliminary step before decoration is attempted. The next step is the elimination of everything that is not absolutely essential to the requirements of a schoolroom.

Color scheme.— The room now consists of four bare walls, windows and doors, a ceiling, and a floor. The color scheme should first be considered. Theoretically, warm colors should prevail in a room with a north exposure. Unless warm and cool colors are suitably grayed, however, the results will not be satisfactory. The accompanying diagram shows the relation of warm colors to cool in the color circle. Their relation to the neutral gray at the center should also be noted: The color becomes more intense as it recedes from the neutral. It is obvious that, as the circle widens, the colors separate and become more brilliant; as they near the center, they become grayer and the relation is closer. Gray colors, therefore, are always more friendly, and, in the end, more pleasing on extensive areas. Gray colors do not need to be dark in value. They may be light or dark, as will be seen from the value scale.

A satisfactory color under most lightings is brown of various degrees of light and dark, or value. It is the soft color of the autumn woods; it hints at the warming rays of the sun without actually suggesting their extreme heat; it is the quiet color of thought, for we often hear the expression, " He is in a brown study."



Nature does her part. We must respond by doing ours

Colors for the schoolroom running from the neutral gray through the Y radius are especially acceptable. Here, again, the colors must be reduced in brilliancy. In the case of some small children, and sometimes in that of grown folk, it is "better to be seen than heard"; the adage applies equally well to the walls of a room — they must be very reserved.

One should not limit a color scheme to yellows and browns alone. Quiet greenish grays, slightly warm or slightly cool, may prove equally acceptable.

Much depends on the amount of light entering the windows, as well as on the position with relation to the points of the compass. Above all things, strong color should be carefully avoided.

The ceiling should be light in value, and the color of the ceiling may extend down on the wall eight to twelve inches or more, according to the height of the room. The upper part of the wall should be slightly darker in value and may extend to the floor or the baseboard, or it may be broken up by a still darker value on a wainscoting or a wall space beginning at about the height of a wainscoting, perhaps three to four feet from the floor. This darker color may be used also on the door and window trims, the molding, and the mopboards. Whatever the color, it should not conflict with the permanent color of the furniture, desks, benches, and chairs. Subdued colors never conflict. Diagram 2 shows good color-value relations.

Color mediums.— Whitewash should not be used if it can possibly be avoided, and with inexpensive paints on the market its use is quite unnecessary. Though sanitary and clean, it is not suited to the schoolroom as a permanent wall-covering. A tinted calcimine is much better than whitewash; and as the lime contained in calcimine is a carbonate instead of a caustic, a wide range of pigments for color effects may be used.

Perhaps the best of the water-color paints related to both whitewash and calcimine by their ingredients are those known as alabastine and muresco. They may be mixed with hot or cold water, and the two may be mixed together. Thus any colors may be obtained, and may be applied with a calcimine brush or an ordinary paintbrush of good width. The writer has seen a water paint applied over an old wall paper with a wonderfully fine effect. The bad figure faintly showing through one coat of paint served as a most pleasing decoration. This operation might not always be so successful, but it serves to show the possibilities of decorating over old surfaces.

The best medium, of course, though it is more expensive than calcimines, is a good oil paint. Oil paint should be carefully applied; before the paint dries, the surface of the wall should be stippled by quick touches with the ends of the bristles of a wide brush. Stippling dulls the surface, makes it less trying to the eyes, and produces a soft background. Some paints, however, are designed to dry out dull, in which case the stippling is unnecessary. Oil paints become a part of the wall surface. If a proper quality of paint is used, it can be readily cleaned with water and good soap. Paints consist of a liquid, or vehicle, and a powdered solid, or pigment. The liquid is linseed oil, which, for interior painting, should be boiled. Old plastered walls may be painted with a priming coat of a size (a thin solution of glue), or a regular priming coat of oil, white lead, and Japan drier; both lead and drier should form but a small part of the whole. The wall may then be treated as is any prepared surface. All these medium's may be readily obtained at the hardware store. Most firms of repute sell prepared priming coats with full instructions.

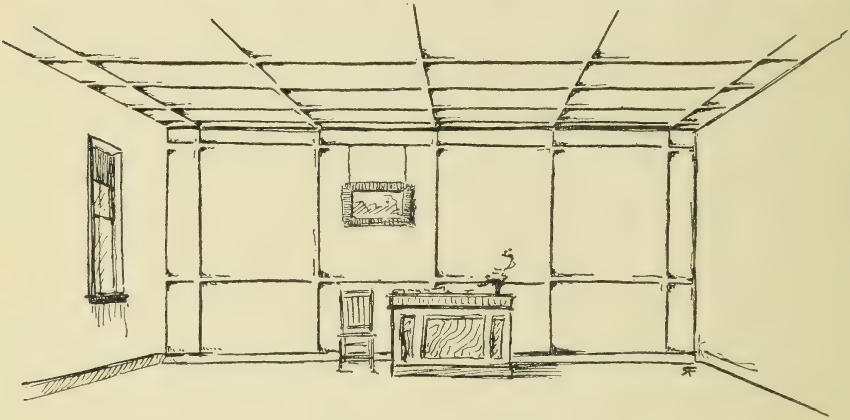
Wall papers.— For schoolrooms, wall paper should be avoided if possible. It is at best unsanitary, especially if used over old paper, and it needs replacing every two or three years. It easily becomes soiled and is subject to wide changes in color from exposure to light. The extent of fading depends on the quality of the paper, but even the best qualities cannot long withstand the direct rays of the sun. Cheap grades of paper should never find their way into a schoolroom. If paper is used, however, ingrains and oatmeal papers are the most desirable from every standpoint. Figured papers should never be used unless one thoroughly understands the principles of design and how they should be applied. It is well to follow the safe plan of using only plain, unfigured paper — when paper must be used — but it must not be forgotten that a ten- or twenty-pound package of alabastine, muresco, or similar mixture is better. Unless paper is put on well, it has a tendency to loosen and come off, thus causing an unsightly room and also providing an excellent place for dust and dirt to collect. Furthermore, the paste used for paper-hanging is likely to sour and breed a foul atmosphere that is injurious to good health.

Walls.— At this point it is well to take up the question of the treatment of various materials used in constructing walls, ceilings, and floors. Walls sheathed with matched boards are usually treated with a varnish and left the natural color of the wood. Why this practice is so customary, it is difficult to understand; the usual yellow result is most unpleasing and varies from a dark chestnut color to a light gilt-yellow on the mottled surface. With much less expense, a wood stain of refined color might better be applied. This, followed by a filler or a wax, makes a most satisfactory surface. If the filler is darker or lighter than the stain, the result is most effective. A warm silvery gray, a gray tinged with a hint of green, or a grayed yellow will afford endless satisfaction on an otherwise ugly surface. Paint is also a good medium for this surface, and should be stippled as before mentioned, unless it is a "flat" paint. Walls of artificial board, as beaver board, or plastergon, may be treated as any natural wood or with water-color paints. When economy is a primary consideration, this material is quite satisfactory and is quickly and easily applied. Plaster is the most satisfactory wall material and should be used in preference to any other.

Ceilings.— Sheathed ceilings are objectionable from the same standpoint as are sheathed walls, but may be made less objectionable by a treatment similar to that described for walls. Artificial-board ceilings are usually good, but these necessitate paneling, owing to the strips that are used to cover the seams. For many persons this is an added source of pleasure, and as a means of decorating is often desirable on wall surfaces. Further reference to paneling is made later.

Like plaster walls, plaster ceilings are always good, but they should be kept light in color, either white or a light value of the general color scheme of the room.

Satisfactory metal ceilings are seldom seen. No doubt they are a safeguard against fire and are of a permanent nature, but, unless they are good from the standpoint of beauty, they are a disfigurement in any schoolroom. Like the average stove, they are usually meek and humble subjects for the application of all kinds of unrelated and scrawly wanderings called "decoration." Fortunately, the nature of the construction has kept metal-ceiling designs largely bisymmetrical or radial in character. The flat metal would not be stiff enough for use without some kind of support. This difficulty is overcome by a number of dents or creases that are made in the surface. For the most part these creases have been poorly designed, and usually appear like heavy overhanging tiles in relief or show geometric traceries and floral forms unrelated to the general proportions of the room.



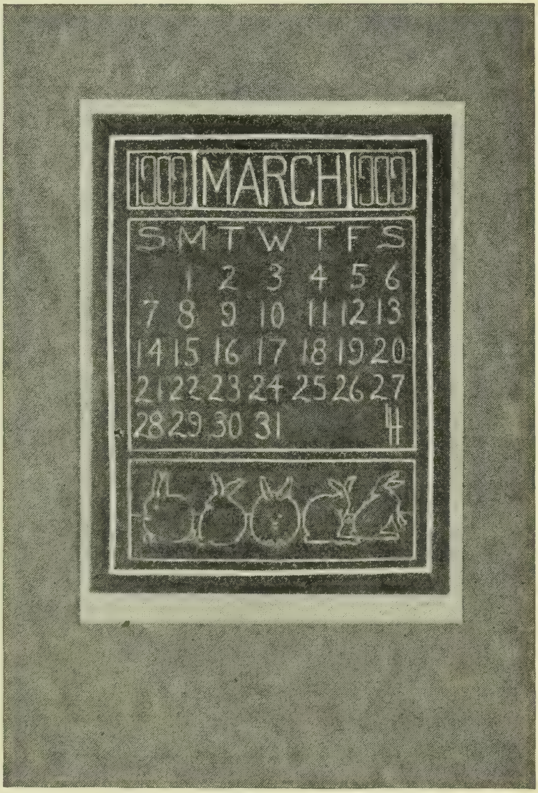
Effect of paneled ceiling

There is no reason why metal ceilings should not be well designed. If simple panels could be produced with the resultant effect similar to that gained with the use of the battens or beaver-board surface, metal ceilings might be most decorative. A good paint is the only satisfactory medium for coloring metal ceilings. If a satisfactory paneling were obtained, the panel lines might be made the color of the walls, the spaces between being lighter. Otherwise, only one light color should be used on the whole surface. Shaded color effects are extremely bad.

Floors.— The most satisfactory floor is one of hardwood with matched strips. Little may be done with the old splintery floor, but a good floor oil or paint may hold it in fair condition for a time. Before either medium is applied, the cracks should be closed with a filler. The good hardwood floor should never be painted, but should be kept in condition with a floor oil. The old floor that has been painted should be slightly darker in value than the walls, and should be of the same hue or color. When this is not convenient, a cool gray or a brownish or greenish gray is satisfactory. The paint should be of a quality that hardens with age.

THE FURNITURE

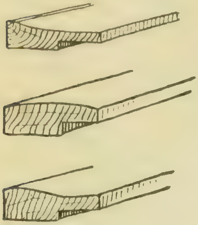
Blackboard.— The best blackboard is of gray slate, and this should be obtained if possible. The dark gray slate color serves as an excellent background and is much superior to a blackboard of any other hue. White chalk against a gray background is much less trying to the eyes than it is against any other background.



Suitable decoration for the blackboard

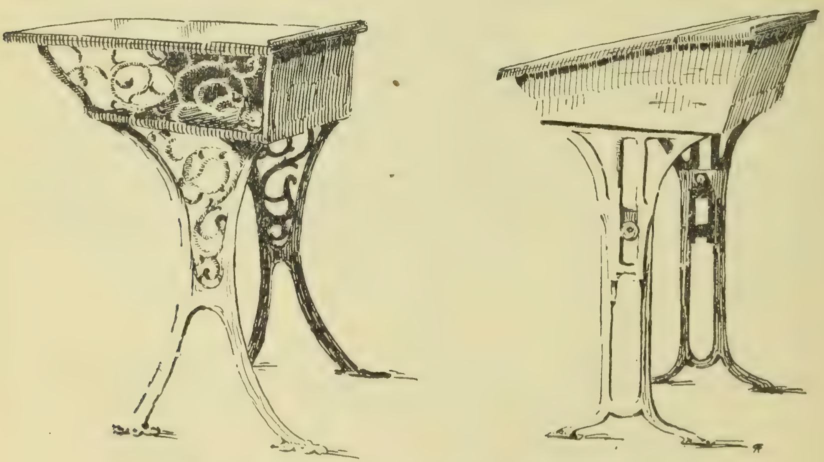
Boards of a paper composition are extremely poor substitutes for slate, as they are susceptible to the weather conditions and warp out of shape. Carefully glued, well-planed boards, thoroughly dried and seasoned, may serve temporarily until a slate board can be procured. This sort of board must, however, be made with extreme care, and a dull, dark-gray preparation on the market should be used for coloring the surface. Such a preparation is often applied to plaster, but a nick in the plaster soon spoils its appearance and proves the inferiority of the scheme.

A serviceable blackboard may be made by stretching heavy building paper over a smooth wall surface and painting a dull black over this. Building paper costs about one dollar for a roll three feet in width and thirty feet in length. The paper may be carefully wet before stretching, care being taken not to tear the damp paper. A simple wooden frame should be tacked over the edges, which will serve to hold it in place when it dries. On rough surfaces the paper may be pasted. Ten cents worth of lampblack mixed with ten cents worth of turpentine will form a good surface paint.



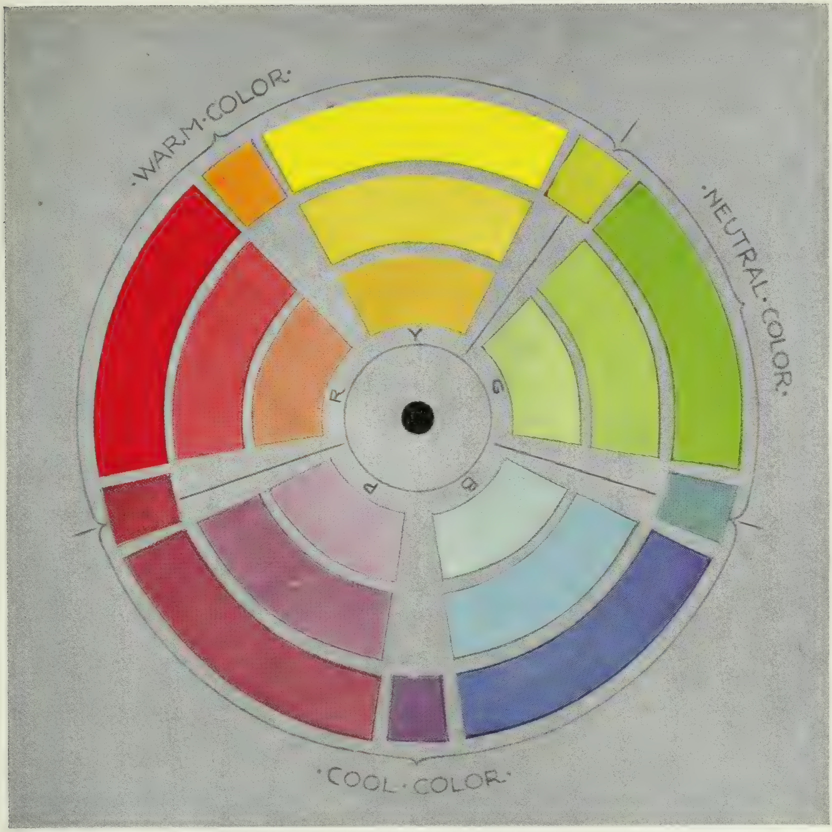
Moldings

All blackboards should be considered as a part of the general decoration, and deserve careful framing with a molding on the top and on the sides unless they are placed between windows or door trims; a top and a bottom molding may then be sufficient. The molding at the bottom should project enough to catch chalk dust or to hold erasers, and should be the widest of all four moldings. Should the board come between door and window trims, the molding may be of a color similar to that of such woodwork. If, however, the boards are smaller and appear as separate units on the wall space, the moldings may be colored to correspond with picture frames or may adhere strictly to a gray, either lighter or darker than the board itself. All moldings should be simple and plain, so that dust cannot adhere readily. Three- to five-inch strips with a slight concave, convex, or reverse-curve surface are excellent.



The beflowered metal standards are objectionable

Most blackboards are too high above the floor. Twenty-six inches is a good height for the average pupil.



·COLOR · CIRCLE·

In the above diagram it will be observed that RED (R) & YELLOW are warm colors, BLUE & PURPLE are cool colors, and GREEN is neutral. A small circle of BLACK is shown within a circle of neutral GRAY at the center, by way of contrast. The GRAY is approximately half way in Value between the BLACK and the WHITE edge of the page.

Colors in full (pigment) Chroma are shown at the circumference. They diminish in Chroma as they appoach the central GRAY. A closer and more friendly relationship is readily seen as the colors become grayer and softer.

Small areas of Complementary colors are shown opposite the five standards R·Y·G·B·P.

The middle circle of color is a mixture of the inner and outer colors.

RF.

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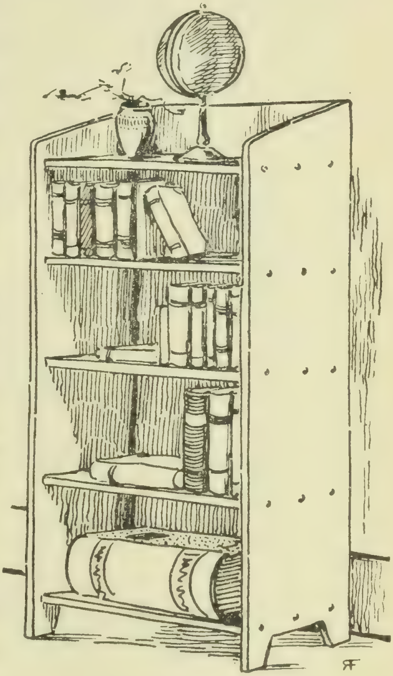
The teacher's desk.— Too often the teacher's desk or table is the one object out of harmony with all other furnishings. When the total equipment of the room is under consideration, this desk should be chosen to harmonize, in design and color, with the children's desks, the cabinets, and the chairs. But the equipping of a schoolroom in such a general way is not always possible when a school board insists that any desk or table will do. In such a case its finish and color may be readily altered, and should be immediately changed to suit the general color scheme of the room. The old finish may be removed in a number of ways: by using a paint- or varnish-remover, with alcohol, or by scraping. For straight work the last-mentioned method is the best and easiest, although any refinishing requires care and patience. The final result, however, always compensates for the time and energy expended. A steel scraper or a piece of window glass will easily remove the old surface. The stain or color may then be applied with a brush and afterward rubbed with wax or a filler. No better manual training for the boys could be devised.

The benches and seats.— The old-fashioned bench is nearly as easy to redeem as the teacher's desk and should be finished in a similar way. The difference in treatment might vary only in the removal of the old finish, for the bench might need the use of a good plane. Once planed to a smooth surface, the treatment follows as for other furniture. Old seats and desk tops may be treated in a similar manner.


Good design at little cost

Unfortunately, the beflowered metal standards for the average wooden desk tops are extremely objectionable in a well-decorated room, but nothing can be done to make them over. Newer standards are better in design, and persons responsible for school equipment should be careful in their selections to seek designs that are simple and consistent in their structural purpose of providing direct support.

The bookcase.— Sectional bookcases are excellent for preserving books, and the newer designs are often beautiful. The school should be a room for study, a shop for work, and a home for growth, training, and an appreciation of the beautiful. All objects in the room should harmonize as much as possible, both in design and in color. The sectional case is usually quite in keeping with dignified surroundings; but the average soap- and stamp-premium bookcase is most inharmonious, with its mirrored top and stamped floral designs. If a plain case of simple construction cannot be obtained, then shelves made of inexpensive wood, stained or painted to match the furnishings of the room, are admirable and are preferable by far to the cheap combinations of elaborate decoration to be found on the market. If the sides are extended above the upper shelf and cut with a decorative line, and if the bottom is cut to suggest standards with the lower shelf raised slightly from the dusty floor, the whole effect will be entirely successful in the complete decorative scheme. Such a bookcase can be very cheaply made. Unless the case has suitable glass doors, the shelves should be uncovered and the books exposed invitingly for the pupils' use.

The museum cabinet.— Every schoolroom should have its museum cabinet. The study of nature, of foreign countries, of local and foreign industry, of beauty itself, each should receive some assistance at first hand. The museum cabinet, then, should be the place for birds, shells, nests, stones, soils, objects from foreign lands, products of industry, collections of illustrations, vases, colored pictures, and a host of other things.

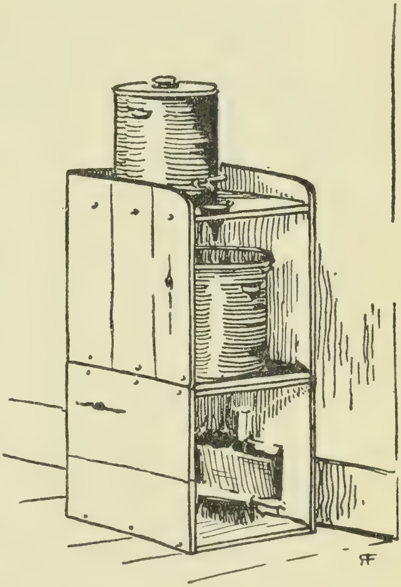
The simple design and harmonious color that have been recommended for the bookcase must apply to this piece of furniture also. If an extra large and extra deep bookcase of simple design cannot be obtained for the museum, then, as with the other articles, three-quarter-inch boards may easily be converted into a cabinet of adequate service. If possible, the cabinet should contain one or more drawers; but in case it consists of shelves only, a number of good-sized filing boxes may be used. The drawers and the boxes should contain the smaller curios, the shelves the larger objects. Much display of taste may be exercised in the arrangement of these objects, for they should serve also as a means of decoration. Perhaps the best plan would be to use the top as a display shelf and to curtain off the lower part of the cabinet. The display shelf may also serve as " the shrine of beauty," which will be discussed later.

After the larger pieces of furniture, it remains for us to mention the smaller, but no less important, objects; not only are they indispensable in the properly equipped room, but they may add to or seriously detract from its decorative appearance.

OTHER ESSENTIALS

Drinking water.— No teacher should submit to the use of an open pail and a rusty dipper, either in the schoolroom or in the entry. This most unsanitary and ugly habit is far too common in the country school. The ideal drinking fountain, with water piped from a spring or a tank, is not always feasible and the good old well is not always at hand. Even the absence of such conveniences is no excuse for the older and unhygienic method of using the open pail. Stone crocks with cover and faucet are not expensive, nor are the many water-coolers and tanks that are advertised on the market. These may be obtained in quiet, neutral grays, or even painted with enamel paints to match the general color scheme of the room.

A stand, on which the drinking water should be set, may then be made of boxes or plain boards. In front an enameled funnel may be inserted in a circular opening in the table, through which waste may run into a pail below. The accompanying sketch illustrates its construction. Placed in direct view of the teacher at the back of the room, with the open side turned toward the wall, such an arrangement has the appearance of a small cabinet and is in harmony with its surroundings. The stain of the general color scheme should, of course, be used on the table. Each child should have his individual drinking cup in his desk or hanging on a hook under the bench.

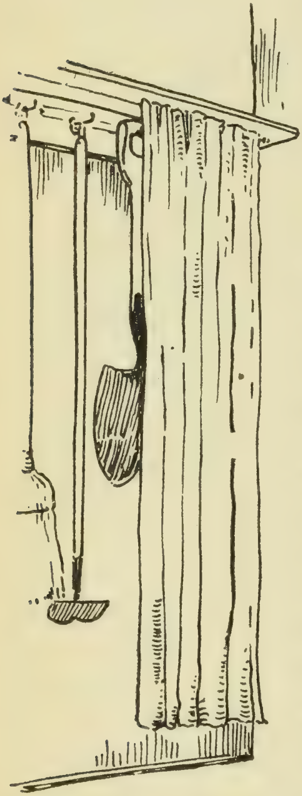


A good stand made of boxes, for the water jar

Extreme care should be taken in thoroughly cleaning crock, faucet, funnel, and pail at regular intervals.

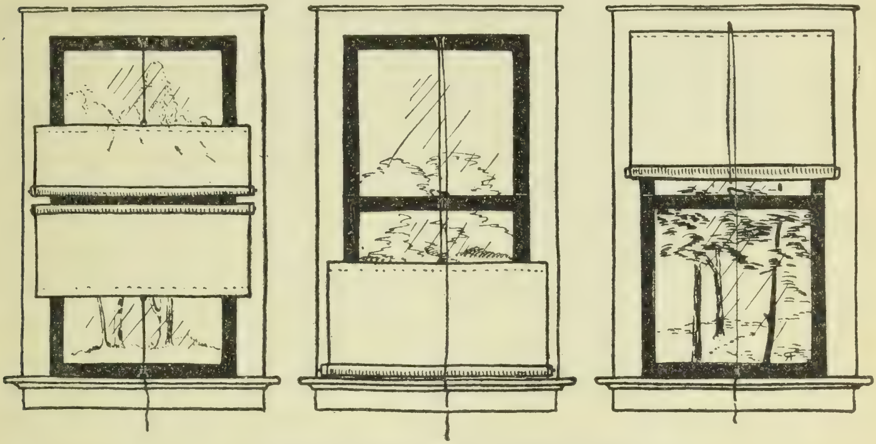
Cleaning and garden tools.— If possible, every school entry should have a tall closet in which brooms, garden tools, and other equipment may be kept. In lieu of such a convenience, hooks may be placed under a projecting shelf, four to eight inches wide, each hook being labeled. It should then be the duty of one of the pupils to be responsible for each tool for a certain period of time. The shelf should be high enough so that the longest garden implement will not touch the floor and interfere with clean sweeping. A plain curtain of burlap may then be hung from the shelf in order to exclude the tools from view. The burlap should hang at least six inches from the floor and not lower than the end of the longest tool. The top of the shelf can then be used for supplies. The resultant effect depends on the neatness with which all tools are placed and the care used in storing material on the shelf. All wraps should be kept in an orderly manner; preferably they should be hung from hooks that are screwed into a projecting shelf, in order to insure a circulation of air about the garments.

This hall, or entry, should have the prevailing color scheme of the schoolroom, and unless both are well lighted the color should be light in value throughout. In the entry the dirt from outdoors is first deposited, and careful sweeping is usually neglected. Plenty of light from windows, and well-chosen color schemes, will do much to remedy this tendency and will also provide for speedy inspection by the teacher of the placing of supplies and wraps.


A place for tools

Window shades and curtains.— Good roller shades of a green-gray or ecru color, according to the general color scheme adopted in the room, should be obtained, if possible. The ideal arrangement, for the sunny side at least, is to have two rollers fastened across the middle of the window. These may be drawn half to the top or half to the bottom at will, or the whole window may be shaded. If it is not possible to obtain double curtains, the next best arrangement is to have one curtain at the bottom. Thus the strong light from above need never be cut off. In case there are no shades, curtains of muslin, cheesecloth, scrim, voile, or curtain madras, preferably plain or else with small, dotted figures, may be stretched from the middle sash to the bottom of the window. These curtains may be run on rods, or caught by means of four rings at the corners over small, brass-headed tacks. The effect desired is a soft light. Flat-hanging curtains are therefore perferable to those having many folds or pleats. They also catch less dust, and, when firmly held above and below as suggested, they do not hang crooked nor blow in a breeze. By attaching the rods or the rings to the sash itself, the lower half of the window may be easily raised or lowered, carrying the curtain with it.

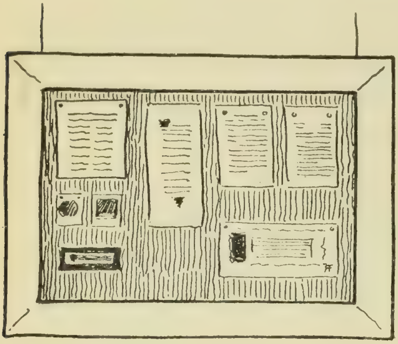
Heavier shades of cambric may be easily made as follows: Cambric of a color that harmonizes with the room may be fastened to an old roller or a round stick and used as the more expensive shade is used. The stick should be the width of the cambric, and both should extend beyond the window on either side. The free end of the shade should be tacked about a thin, flat stick and securely fastened at the top of the window. A cord, three times the length of the window and a few inches over, should be tacked to the middle of the underside of the stick, passed under the roller shade, up to the middle of the top edge of the window frame, through a screw eye or a small pulley, and then down to a hook at the middle of the sill. By pulling on the cord, the curtain may be rolled up at will, the cord being tied at the bottom of the sash.



Arrangements for hanging window shades

The bulletin board.— An otherwise well-decorated room may be completely spoiled by the display of school work and of penny prints hung in rows above the blackboards. Presumably this material is intended to be seen, and such a position merely defeats the end in view. Again, the nature of the material is such that hanging in this manner produces an unsightly curling of corners and a tilting one way and another, for the papers are usually fastened at the two upper corners only. Obviously this sort of decoration is not good. The displaying of school work, however, is to be commended, and there should be a proper place for it — a space to be considered in the general scheme of decoration.

The school bulletin board offers this opportunity, and all material that is of a more or less temporary nature should be securely mounted thereon with tacks or pins. A sheet of artificial board, many kinds of which are widely advertised, serves as an excellent surface; it is light and inexpensive, and it may be tinted to suit any color scheme. Tacks may be quickly inserted and easily removed. Unless placed between door or window casings, it should be framed like any picture but without glass. If framing is impracticable, a dark band two or three inches wide may be painted around the edge of the board, thus giving the appearance of a frame.



The bulletin board should be carefully arranged and securely mounted

If the composition, or manufactured, board is not obtainable, a wide, smooth, and flat piece of soft pine, or two pieces carefully joined together, may be used instead. These may be stained, or covered with a soft-colored denim or the more expensive monks' cloth. The advantage of a covering lies in the fact that the holes do not show.

The bulletin board may be hung as a picture with two vertical wires, or it may be fastened directly to the wall.

Constant care should be used in tacking up pictures, notices, or school work. Objects remaining on the wall for some time, such as the school schedule, should be secured at the four corners. A good margin or frame should always be preserved about the edge of the bulletin board, and good spacing should be carefully studied. Decorative effects should *never* be sought. This is not the purpose of the board. All work should be squarely placed and carefully grouped, not scattered. The board should never be crowded. Crowding not only would look bad, but also would detract from the intent to show good work or display particular pictures.

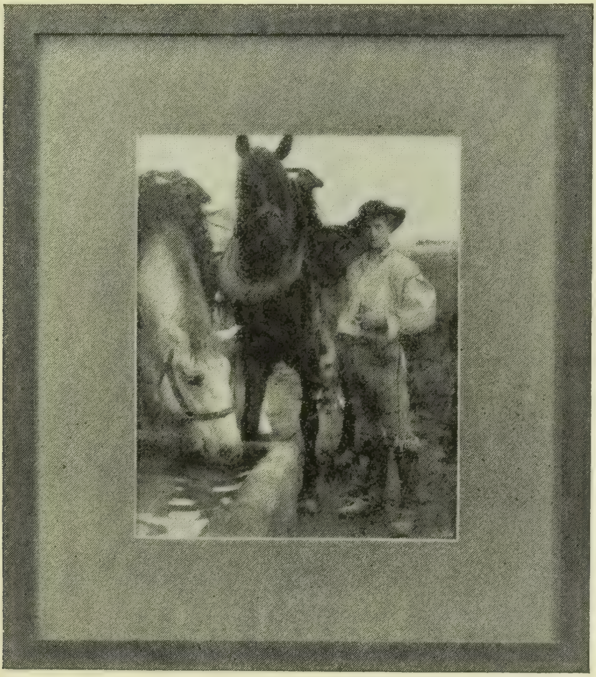
The board should be placed where all may readily see it in passing to and from the room. Its use should be largely confined to honor papers or important bulletins and illustrations. The hanging of a paper should then become a reward for which all would strive.

Maps.— Maps should never be hung unrolled for any length of time. They are never objects of great beauty, and they detract from the appearance of the room. The best maps are attached to patent rollers, and when not in use they should be rolled from sight. They should never stand on end, but should hang on pegs or hooks so that they rest horizontally. An excellent place for the map is at the top of the blackboard, where it is out of the way and does not mar the general effect of the decoration. In order to keep it from the dust, a box that is open at the bottom should be made to fit over the map when it is rolled. A rod should then be attached to the inside at either end, and the box suspended from the upper frame of the blackboard. The color of the box should match that of the other woodwork, so as to be as inconspicuous as possible.

The chief objection to the older maps was the intense color. Modern maps are much better in this respect, but it is to be hoped that still quieter colors will eventually be used.

Pictures.— No room is complete without some fine pictures. Modern processes of reproduction have reduced their cost to a minimum, and the latest inventions in printing have made possible the most faithful copying of the finest works of art, both in monochrome and in color. The masterpieces of the early painters are not the only good pictures to be obtained. Many fine illustrations in the magazines and lithographic reproductions of modern painters offer fine examples for schoolroom decoration.

No picture should be chosen solely for the subject. Unless it has the merit of beauty for its own sake, it should never be hung as a permanent decoration. Poor prints of a popular subject do not make fine pictures. Pictures with fine detail are seldom suitable for wall decoration. Therefore etchings are not good. Large, simple masses should predominate, and unless the picture is in strong light these masses should show good contrast of light and dark.



At the Watering Trough
by
Dagnan-Bouveret

When monochromatic pictures are desired, the better grade of carbon and sepia photographs should be obtained. For color, comparatively inexpensive lithographs of German, French, or English make may be purchased from American importers. The well-known Rhine prints are of this grade of lithographs. The better grade of Japanese prints make excellent color pictures.

In the average rural school of mixed grades, the pictures should appeal happily to all ages. The best subjects are those that appeal to the sense of real living and to a wholesome interest in the pictorial elements. Strong action, animal and child life, and daily occupations are best suited to the usual child. For this reason Dupré's "Escaped Cow," Landseer's "Dignity and Impudence," Reynolds' "Age of Innocence," and Lerolle's "By the River" are especially good. While many portraits and Madonnas are among the world's greatest treasures, they are not, as a rule, especially well adapted to the schoolroom.

The following lists are suggestive of suitable pictures for the schoolroom:

Color prints (Rhine prints, and others)

The Plowman	George
Ripening Wheatfield	Van Volkman
Acropolis	DeBois-Renmond
Solitary Valley	Schacht
Swans	Schramm-Zittau
The Seagulls	Matthall
Harvest Time	Hosse
Call of the Shepherd	Van Volkman
Old King Cole	Rehm-Victor
Red Riding-hood	Herrmann

Photographic prints

Grade 1

Madonna of the Chair	Raphael
Age of Innocence	Reynolds
Children of the Shell	Murillo
Feeding Her Birds	Millet
The First Step	Millet
Hiawatha	Norris

Grade 2

Return to the Farm	Troyon
Divine Shepherd	Murillo
Mother and Child	Toulmouche

The Drinking Trough	Dupré
Interior of a Cottage	Israels
"Can't you Talk?"	Holmes

Grade 3

The Balloon	Dupré
Potato Planting	Millet
Penelope Boothby	Reynolds
Little Samuel	Reynolds
Shepherd and His Flock	Bonheur
Caritas	Thayer

A room lacking unity and therefore poorly decorated, but one containing more than enough rich material to produce beauty

Grade 4

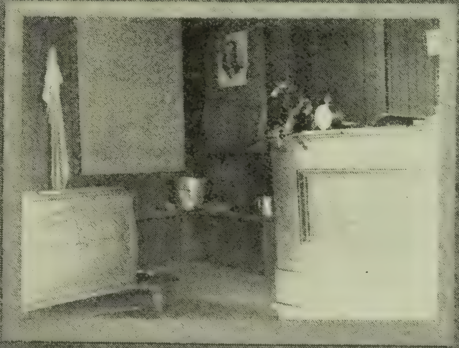
Escaped Cow	Dupré
Arrival of the Shepherds	Lerolle
A Helping Hand	Renouf
Sistine Madonna (Madonna and Child — detail)	Raphael
Pied Piper of Hamelin	Kaulbach
Little Rose	Whistler

Grade 5

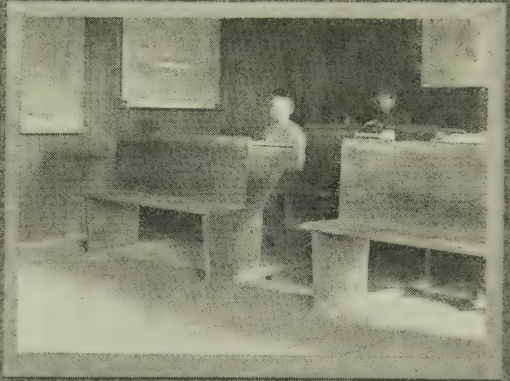
Shepherdess	Lerolle
End of Day	Adan

Autumn	Mauve
Song of the Lark	Breton
Gleaners	Millet
"All's Well"	Homer
Grade 6	
Sir Galahad	Watts
The Sower	Millet
Horse Fair	Bonheur
Puritans Watching for Relief Ships	Boughton
Reading Homer	Alma-Tadema
Fog Warning	Homer
Grade 7	
Fighting Teméraire	Turner
Golden Stairs	Burne-Jones
Water Gate	Van Marcke
William II of Nassau	Van Dyck
Spring	Corot
Shaw Memorial	St. Gaudens
Grade 8	
Water Carrier	Millet
Temperance	Burne-Jones
The Mill	Rembrandt
Madonna of the Workshop	Dagnan-Bouveret
The Haymaker	Adan
Pot of Basil	Alexander

Pictures should be framed in plain, comparatively flat molding. When the elements of the composition extend to the edge of the picture, a mat may be required. "At the Watering Trough" by Dagnan-Bouveret, is one of this type. Corot's landscapes, and such a picture as Whistler's "Little Rose," have plenty of space around the subject, and a mat is not needed. The lower margin of the mat should be slightly wider than the other three sides, for the sake of stability and visual balance. In color it should be analogous to the general scheme of the picture. In value it should be darker than the lightest parts and lighter than the darkest parts, or about equal to the middle values. The frame should then be a continuation of and slightly darker than the mat. For a picture without a mat, the frame should in turn approximate the middle values of the picture.



"No teacher should tamely submit to an open pail and rusty dipper in the room." Aside from the question of health, Beauty can never be obtained where Ugliness prevails.



"Beauty is the purgation of superfluities." Here is the first requisite to Beauty. Thoughtfully placed decoration only is needed.

For colored prints, the frame may be similar in value and color to the predominating hue of the picture. Often, when the color is rich and strong, a dull gold frame is suitable. It is not difficult to stain a natural wood frame to suit any color by mixing oil paints with turpentine. The expense is reduced to a minimum when small cans of paint are obtained or when paint in tubes is used. Easy dyes and even water colors may be tried, and the color held by an application of ordinary floor wax carefully rubbed over the color or into the grain.

Oftentimes old mirrors or discarded picture frames may be scraped, restained, and used acceptably, thus saving the cost of having a frame made. Such frames should never be used without being refinished unless they are adapted in color. A good picture may be made poor by the character of its frame. This applies, also, to any decoration in a frame. Brass or other metal, glass, putty, and other sham applications, are to be spurned under all conditions.

Some color prints may be enriched by simple, carved gold frames, but for the average print the frame should present a plain or slightly molded surface, a " little space of silence " about the picture.

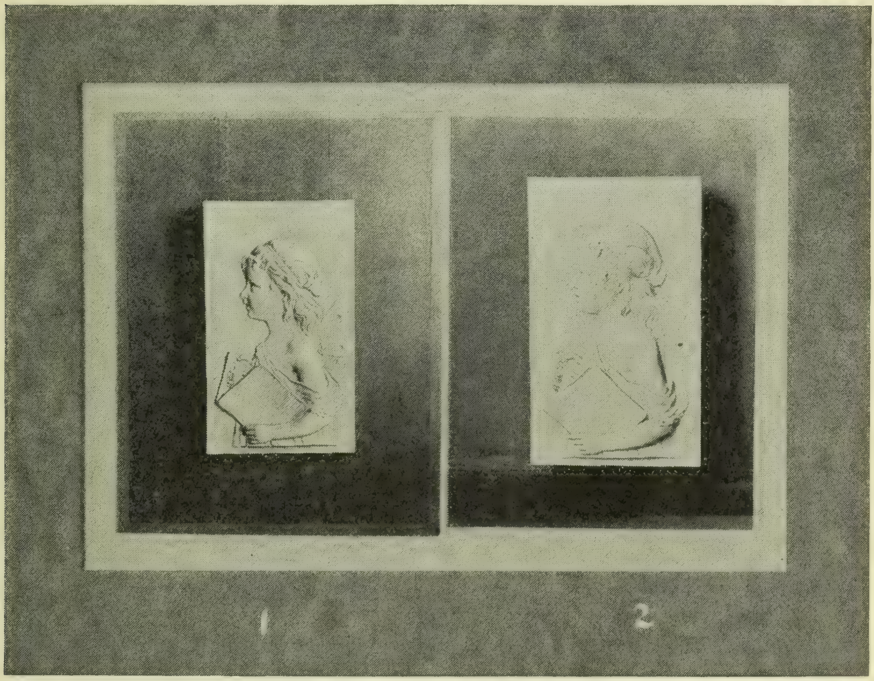
The width of the frame depends on the size and the character of the picture. Naturally, large pictures demand wider frames than do small ones. Unmatted pictures with plenty of margin do not need as wide frames as do those in which the detail comes nearly to the edge. If mats are used, the frame should nearly always be narrow. Often a small picture of strong contrasts of value or color may be emphasized by a very wide mat and a narrow frame. Under no circumstances, however, should the frame be of extreme width, for if the frame is too wide it overpowers and destroys the general effect of the picture.

Few people are able to estimate the exact width and the proper value of a frame or a mat at once, and therefore hasty choosing should be discouraged. It is largely a matter of trying one effect after another until the decision "comes"; as when, in solving a good puzzle, a person knows when he obtains the correct result. Careful and thoughtful consideration of all the points of good framing will prevent serious blunders, but two or three trials are usually necessary before a wise selection is made. The time spent on the extra trials is always justified by the final result.

Casts.— Too few casts are displayed in the modern schoolroom. At the present time good casts are no more expensive than good prints, and in some respects they are vastly superior. They suggest or actually present the third dimension, the actual feeling of form and line, which a picture cannot give. One or two good casts and a few good pictures make a good combination.

The best casts for school purposes are cream in color and have been so treated that they may be carefully dusted with a damp cloth from time to time.

Suitable subjects for school use do not include the usual busts of great men, unless the original is a work of recognized worth. Reliefs are never good if made from some historic or other painting. "The Spirit of '76" is often seen in the relief cast. As a work of art this painting was of fair but not great merit, and it was executed on a perfectly flat surface. Its effect depended on light and shade and color handling. To reproduce this in three dimensions is not only artistically bad, but quite impossible, for the cast demands peculiar lighting conditions and does not depend on color. The result, therefore, is a poor symbol of the original and suggests misplaced enthusiasm.



1. *Cast in good light — profile clearly defined*
2. *Cast in poor light — weak and flat*

Casts from originals by the master Greeks and the greater Renaissance masters are excellent both in relief and in the round. Such works include:

Victory of Samothrace
Venus de Milo
Apollo
Frieze of the Parthenon

Victory Tying Sandals	
Angels with Musical Instruments	Donatello
The Foundling Babes	Della Robbia
Infant St. John	Donatello
Singing Boys with Scroll	Della Robbia

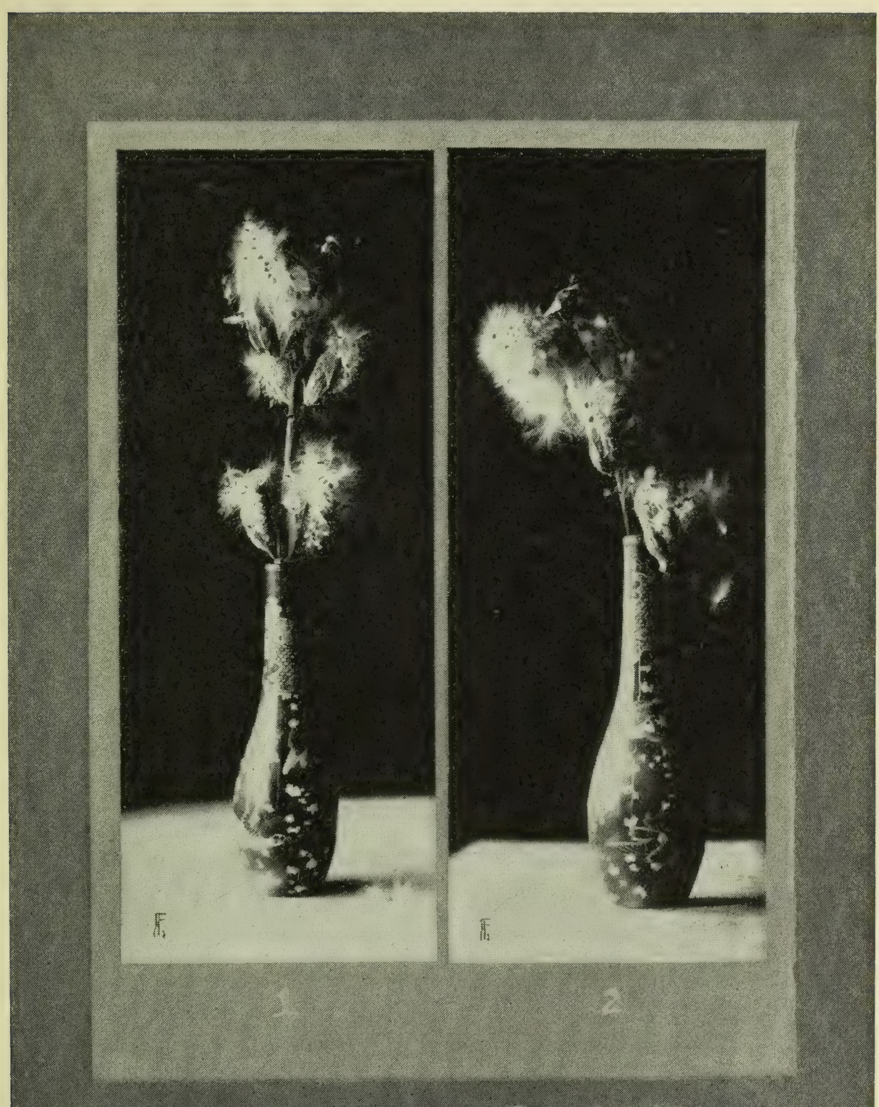
Good modern subjects are:

Animals	Barye
Paul Revere	Dallin
The Indian	Dallin
David	Merci

Casts should never be placed in front of windows, but should be seen against a neutral background. The effects of various lightings should be noted, and the position that best defines the cast should be retained if possible. Casts in the round may be placed on simple, unobtrusive pedestals, wall brackets, or bookcases, and turned to receive the best lighting. Reliefs may be framed like pictures, and, if heavy, should at least rest on a firm molding and be firmly secured to the wall at the back. The frame may be a simple piece of heavy wood, thick enough to receive the full depth of the relief and tinted a harmonizing color, or it may be covered with burlap or other textile in order to soften the contrast between the cast and the wall.

Vases, flowers, and plants.— No room need go without flowers in spring and fall. They are a constant source of delight and serve as an effective means of decoration. Vases for flowers should be unobtrusive and particularly adapted to their use. Vases of variegated colors or serrated edges are not in accord with this principle. Those with projecting figures and sandpaper surfaces are likewise bad. A plain glass tumbler is excellent for many flowers, and other simple forms of plain glass are equally suitable. They allow the stems of flowers to be visible and do not in any way detract from the beauty of nature. Other forms of glazed pottery, grayed in color and simple in line, are good. In any case the vase should be stable and should stand squarely on its base.

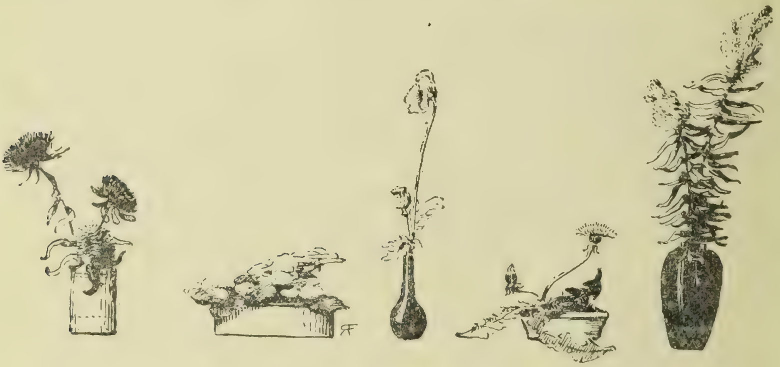
Flowers gathered thoughtlessly, and heedlessly thrust into any receptacle, may prove far from being beautiful. Blossoms of a kind should be kept together and all others weeded out. Their shape should determine the vase to be used. Buttercups would require a less bulky shape of vase than would a mass of lilac blossoms, and the pansy looks better in a shallow vase than does the daisy. A common earthen crock is an excellent receptacle for great armfuls of daisies, and a delicate, flaring-shaped vase may suitably contain the violets. Often one single flower, such as a spray of goldenrod, will look well springing from a tall, narrow-necked vase.



Suggestions for the Beauty Shrine
1-Formal-stiff 2-Less formal
and more pleasing

In arranging flowers, some definite scheme should be kept in mind. Either a rhythmic series of blossoms of varying heights, or simple massed effects, are desirable. In the first instance the composition is usually best seen from one point, and in placing the decoration in the room this should be taken into account. Stems should not be of the same length, and flowers should never be tightly bunched together. The illustration makes clear a number of ways of arranging flowers. Careful judgment may well be expended in all arrangements.

Plants, also, are an excellent means of decoration in the schoolroom. Long, narrow boxes, of the width of the windows, may be made from packing boxes and, if possible, should be lined with zinc. Stained to match the interior woodwork, they become a permanent decorative feature of no little value.

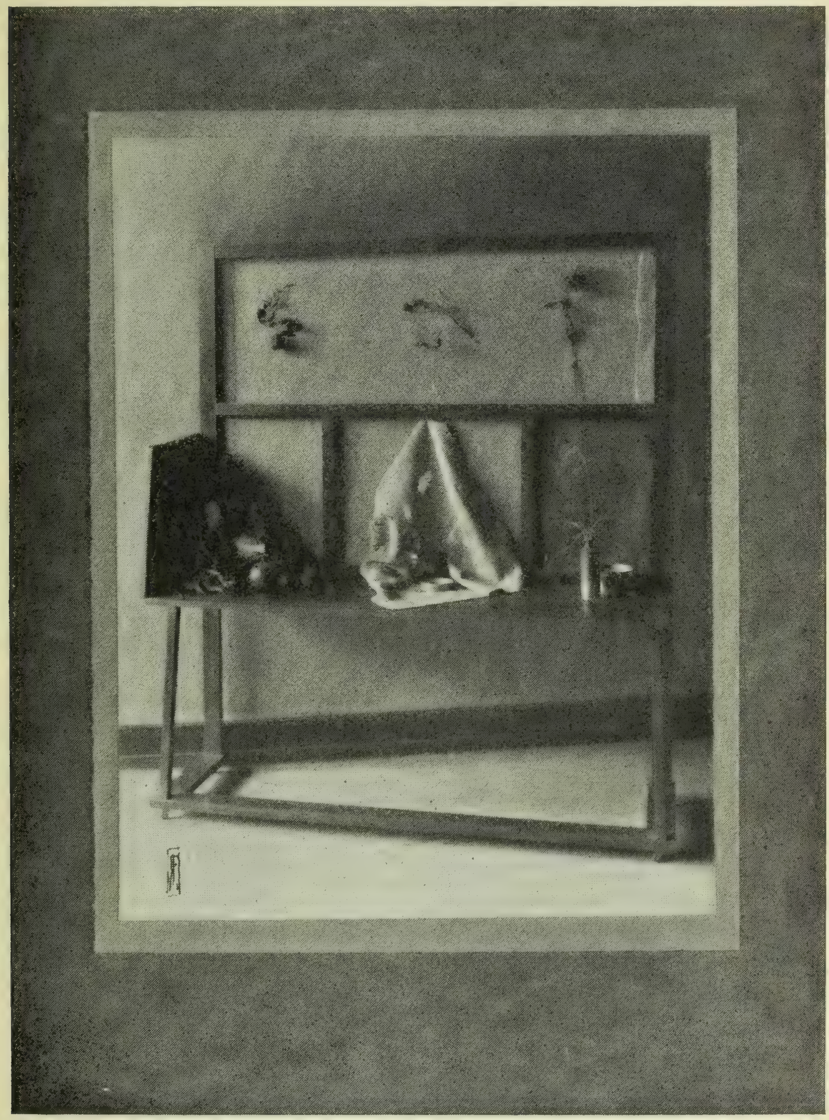


Suggestive arrangements of flowers

Single plants may be placed in flowerpots or in receptacles made of cans. The usual red flowerpots may be beautifully decorated by means of a brush and india ink or black paint. Bands and stripes may be relieved by spotted borders in manifold variety. Such decoration is preferable to an attempt to disguise the fired clay material by means of crepe paper or colored paints. For old flowerpots, discolored by repeated use, paint is perhaps the only satisfactory covering. Ordinary tomato cans may be colored; when the paint is dry, stripes or spotted designs may be added. When using a color, the general scheme of the room should be taken into consideration.

A word may be said here for the vase that exists for its own sake. All vases may be classed under two heads: those that serve as receptacles for beautiful objects, and those that are objects of beauty in themselves. The first have been discussed, the latter may receive some attention.

Beautiful vases appeal to the observer from three standpoints: their line and form, their color, and the character of their glaze. A graceful curve and well-adjusted proportions are difficult to describe, and no recipe can be given by which they may be identified. They are the result of the



Suggested groups for the shrine of beauty
(See page 1270)

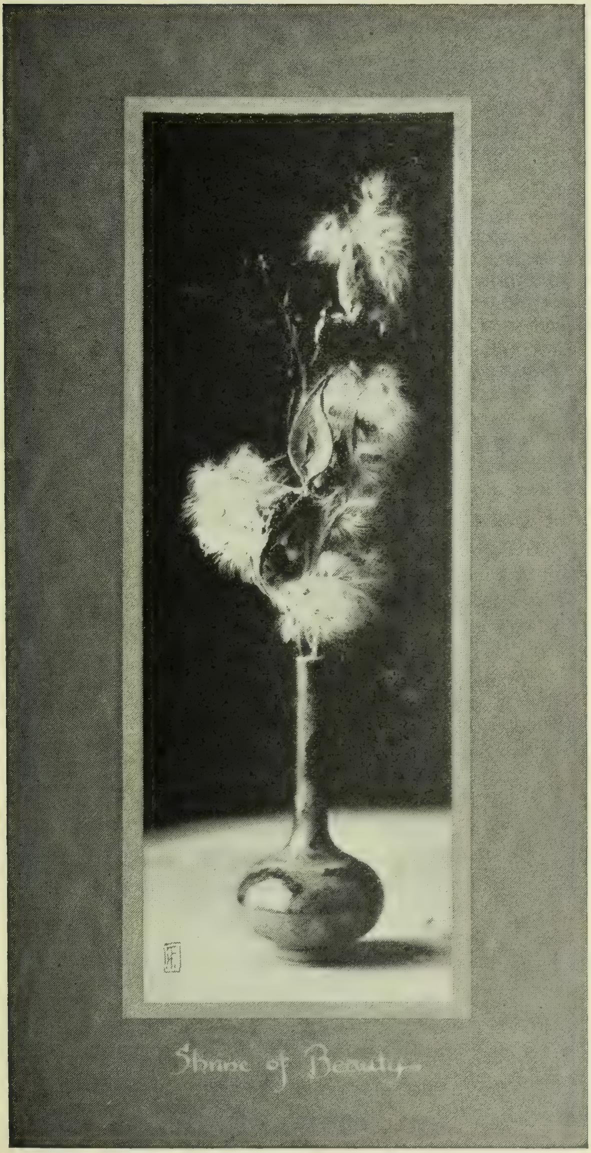
spiritual efficiency of the artist and are products of a mind tuned to beauty. Unless there is a response in the beholder, the beauty is passed by. But appreciation, which is one important office of art education in our schools, may be developed. In general, good curves must spring from the base with rhythmic vigor. No two parts of the curve may be the same, for variety rather than monotony is desired. Good proportions involve the same principles, and a sense of heaviness or of leanness should be replaced by a feeling of well-related parts. Lines should suggest buoyancy, while proportion suggests stability.

Good color may range from brilliant hues to quiet grays. If strong in color, the beauty depends largely on the surroundings; quite naturally, such a vase demands isolation. Grayer colors may associate more freely and be equally pleasing. Quality of glaze and color are so closely related that it is undesirable to separate them. Glazes may be dull or glossy, but should never give an unpleasant sensation to the beholder. Rough glazes like the surface of sandpaper are not good. Mottled glazes and colors may be very beautiful, but more often in the cheaper vase forms they are not.

It is generally true that beautiful vases are not found in the average store and seldom make their way into the rural school. As a means of decoration they may be of great value, but because of the difficulty in obtaining them their use is therefore limited. Once in a great while, a quiet, refined vase may be discovered even in a five- and ten-cent store, but usually these cheaper forms have no art value.

The flag.— The American flag is perhaps the most difficult object to use in a school-decoration scheme. It is intended to be triumphantly flying in the breeze from the top of a flagstaff and was never meant to be used in combination with indoor decoration. The colors are brilliant and the design non-bisymmetrical. If it must be displayed, the flag need not be larger than eight by ten or twelve inches, and, if framed flat, may be treated in a composition with other objects. Another device of some merit is to have a small flagstaff inserted in some weighted receptacle and allow the flag to hang naturally in folds. A large flag, certainly, should not be permanently displayed in any schoolroom. If the flag must be there, the smaller it is, the better.

The shrine of beauty.—Every schoolroom should have its shrine of beauty or a place where beautiful objects may be tastefully displayed. It may be in a corner or on a cabinet or a table, and should be changed at weekly or monthly periods. Pupils may easily be led to watch eagerly for the new beauty and will themselves soon demand a part in producing it. Fine taste, appreciation, culture, all the better elements of a child's nature, may be quietly brought to the roughened surface. Here the



Shrine of Beauty

beautiful vase form may play its part and serve as a means of developing refinement in the pupil. The beauty shrine may have a background of a beautiful piece of cloth, silk, brocade, or velvet, and in front of this should be placed such objects as may be gathered from time to time. The school museum will serve to aid in this work, and no source whereby material may be gained should be neglected.

The shrine may display the beauties of nature or the works of man, and may range from a beautiful flower, feather, shell, or insect to a vase, a cast, a book, a carving, or a textile. Interesting groups may be composed, one central idea predominating; and again one single object may be adequate. A fine bunch of fall berries may be supported in a good vase form, which is in front of a quiet background of brown burlap; or a beautiful bird's nest may serve on another occasion. The particular type of beauty may take the form of color, as in spring blossoms; or of fine arrangement, as flowers in a vase; or of works of fine art, as pictures; or objects of beautiful technique, as a beautiful old Paisley shawl. The field is as unlimited as the joy and inspiration to be gained from week to week. The periodical surprise planned by a different pupil each time, under the teacher's guidance, may serve to awaken the unresponsive pupil and renew interest in all.

The following are suggestive objects for use in the shrine of beauty:

Nature forms

Feathers
Nests
Dried weeds
Branches of
    Berries
    Fruit
    Leaves and blossoms
Flowers
Fruits
Vegetables
Stones
Shells

Constructed forms

Fine textiles
Beautifully bound books
Carving
Inlaid objects
Vase forms
Casts
Pictures
Art craft objects (if beautifully executed and designed)
Jewelry
China

Beauty in arrangement must always be based on principles of good design. The following points must receive due consideration:

1. Only *one* story should be told at a time.
2. If more than one object is used, only *one* object *must predominate.*
3. The group must be *well balanced.*
4. *Objects* must be *in harmony.*
5. *Colors* must *harmonize.*

ARRANGEMENT OF THE SCHOOL DECORATION

The pupils' desks are necessarily fixed in the middle of the floor space, with an aisle running around the outside as well as between rows. The location of the teacher's desk may be directly in the front of the room, at one side and in front, or in the rear. The teacher decides this for herself. The stove, if of the most improved pattern, is in the rear of the room; if not, it is in the center of the room or in front and at one side of the desks. All other objects may be moved about at will, and the arrangement may mar, or make good, the decoration.

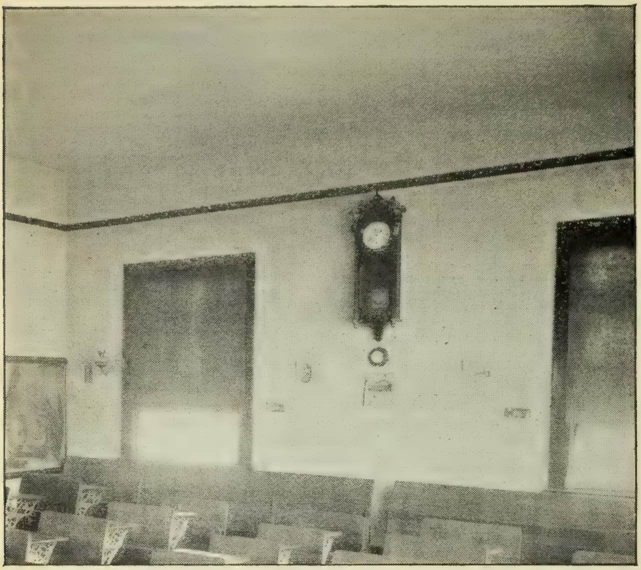
Interest may be centered in groups about the room as follows:

Group I. *Windows, shades, and flowers.*—If a long window box is used for flowers, it should be placed inside in winter and outside in summer. If the window is low, the box may rest on the sill. If it is high, the box should rest on a shelf or on brackets in front and below the sill. The reason for such arrangement is plain: if it were on the high sill, the box would cut off the light, and the flowers seen against the bright sky would appear as dark silhouettes and their full beauty would be lost. In this group the flowers are the center of interest and should be placed to good advantage.

Group II. *Windows, small pictures, clock, calendar, and thermometer.*— In this group the windows should be subordinated to the two centers of attraction. The recording mediums, the clock, the thermometer, and the calendar form one center, the pictures the other. In this group in which the pictures are so small, the wall space may be designed particularly for them. Artificial-board battens or strips of wood may be used to form interesting panels in which the elements are carefully grouped. This gives opportunity also for separating the centers of interest and at the same time confining them within proper bounds. The final result is highly satisfactory. When there is a big field of blank wall space, strips of wood or stripes of color should be used to relieve the surface in this way.

Group III. *A bookcase or museum cabinet, pictures, blackboard, and chairs.*— In this group the museum cabinet or the bookcase is of chief interest. A symmetrical arrangement may be possible, with the cabinet in the center and the subordinate interest, chairs, pictures, and blackboard, arranged on either side. The chairs acting as guards, with the central picture slightly lowered, give emphasis to the central interest. An arrangement at one end of the wall may retain the interest if objects outside of those in the group are separated by a considerable space.

Pictures and the bulletin board should be hung with two vertical wires or with the support hidden. When hung with a single wire, a triangular space is formed that is out of harmony with the wall space and the shape of the picture that it suspends. In addition, the eye naturally follows the receding lines meeting at the point on the molding, and is thus distracted from the picture below.



Decoration small and lost on big wall space (II)

The water supply should be placed in the least conspicuous place. At the same time it must be easily accessible.

In general, the objects in a room should never appear scattered. They should be carefully and invitingly grouped.

DO'S AND DON'T'S

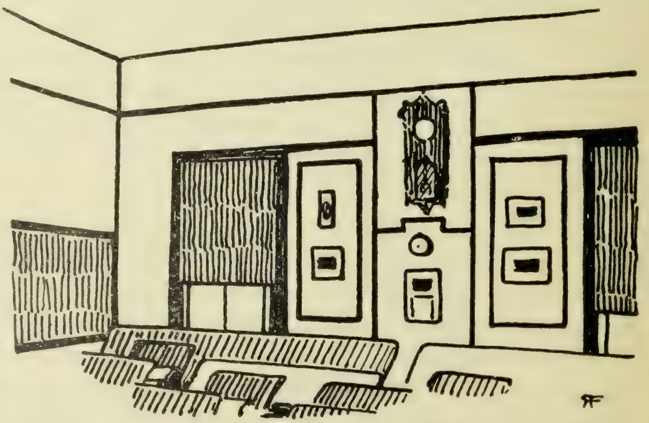
The following is a brief summary of what may and may not be done in a well-decorated schoolroom:

Keep color schemes quiet and in gray.

Use a good paint for walls, if possible.

Keep the walls and the ceiling light.

Have good hardwood floors, and keep them well-swept and oiled.



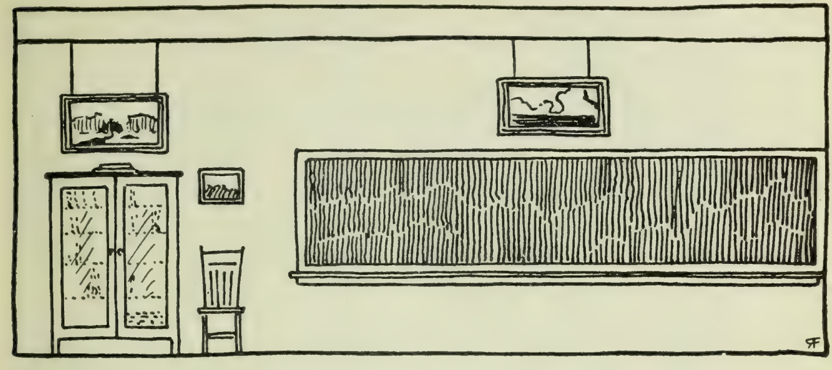
Panel arrangement using same objects for decorative scheme (II)

Provide gray slate blackboards.

Keep all furniture consistent in color and finish, if possible.

Seek plain, unadorned metal standards for pupils' desks when purchasing equipment.

Keep all objects in their appointed places.



Objects at one end of wall space (*III*)

Hang all display work on the bulletin board.

Keep maps rolled.

Hang pictures with two vertical wires.

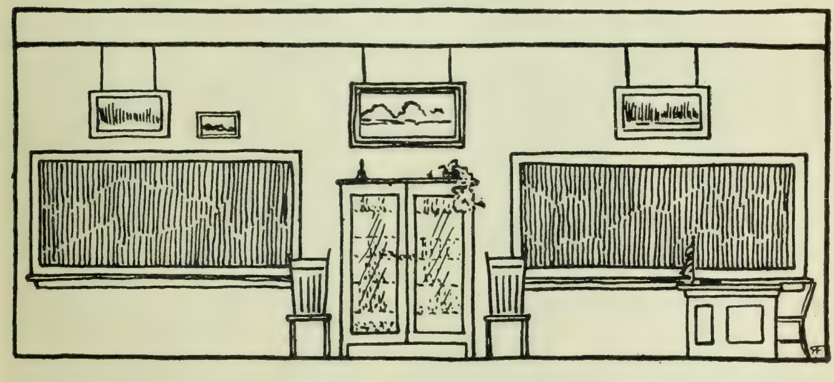
Make the pupils responsible for the decoration.

Seek for unity of effect.

Do not allow brilliant colors in pictures and in large areas.

Do not allow dark or strong colors on walls.

Avoid wall papers.

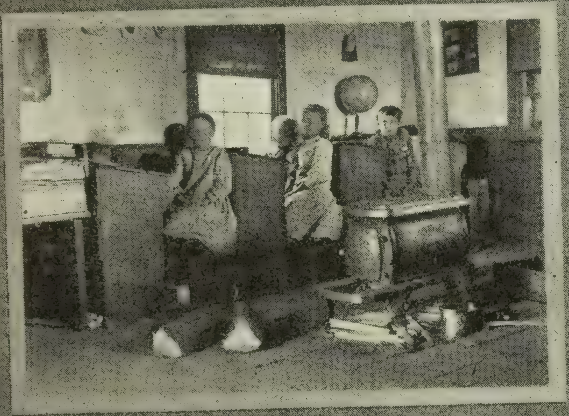


Symmetrical arrangement (*III*)

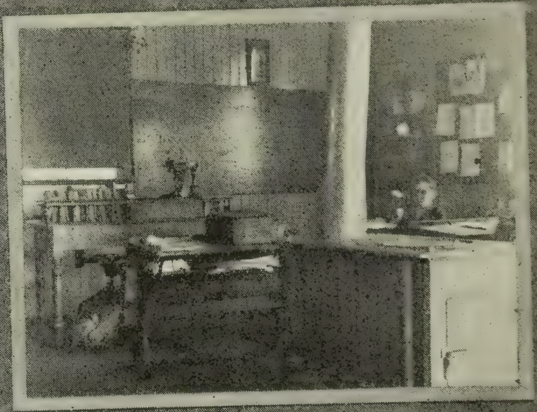
Do not place blackboards too high.

Do not allow a class cup and open drinking water.

Do not allow clothing to be thrown at random over benches and desks.



An unfortunate but consistent room; unfortunate because of the misplaced and scattered decoration, consistent for everything is scattered. What opportunity!



A fine start with Bulletin board and flowers. Better grouping with a—supreme center of interest would—quickly enhance the righthand corner.

Do not paper the walls with class work.
Do not use fancy vases for flowers.
Do not neglect the shrine of beauty.
Avoid objects which are imitations either in material or shape.
Do not scatter the decoration.

COST PRICES AND APPROXIMATE EXPENSES

The following prices are approximate and are given merely as guides:

Paints

About 300 square feet of surface is covered by a gallon of paint, two coats being applied.

Oil paints		
Floor paints	per gallon	$1.25 to $2.00
Wall and wood paints	per gallon	1.40 to 2.50
Blackboard paints	⅛ gallon cans	.25
Floor oil	gallon cans	.50 to .75
Water colors		
Muresco	five pounds	.30
Alabastine	five pounds	.40
Fillers		
Wood filler	per pound	.18 to .22
Crack filler (paste)	per pound	.17 to .25
Liquid	per gallon	1.25 to 1.75
Stains	per gallon	1.50 to 3.00

A partial list of reliable paint firms follows:

The Sherwin Williams Paint Company, Cleveland, Ohio
S. C. Johnson & Son, Racine, Wisconsin
The Bridgeport Wood Finishing Company, New Milford, Connecticut
Acme White Lead Works, Detroit, Michigan
Heath and Milligan Manufacturing Company, Chicago, Illinois
Berry Brothers, Detroit, Michigan
Marietta Paint and Color Company, Marietta, Ohio
The Hazard Lead Works, Hazardville, Connecticut
Benjamin Moore & Co. (muresco and paints), New York City
Alabastine Company, Grand Rapids, Michigan

Information relative to the application of paints and stain may be obtained in free booklets and sample cards from the foregoing firms and from many others.

Artificial wall boards

The average cost of artificial wall board is three cents a square foot. The boards come in large sheets of varying widths and lengths, ranging from 30 inches by 6 feet to 36 inches by 9 feet.

The following is a list of places where wall covering is manufactured:

Beaver board	Buffalo, New York
Plastergon	North Tonawanda, New York
Utility board	Chicago, Illinois
Neponsit wall board	East Walpole, Massachusetts
Roberts wall board	Marion, Indiana
Carey ceil board	Locland, Cincinnati, Ohio
National plaster board	Cleveland, Ohio
Compo board	Minneapolis, Minnesota

Miscellaneous furnishings

Wall papers

Single rolls	5 to 50 cents
Double rolls	30 to 45 cents
Ingrains (a bolt of three rolls)	30 cents to $1.50

Shaaes	30 to 60 cents

Curtain materials	Width (inches)	Cost (cents)
Muslin (unbleached)	36	8
Cheesecloth	.....	12
Crepes (plain)	27	16 up
Muslin	27	16
Voile (plain)	40	16
Madras	27	18
Burlap	36	20
Scrim	36 to 40	25 to 3
Denim	36	27
Nets	36	35
Cambrics	38	38
Marquisette	40	39
Colonial nets	40	39

Curtain materials	Width (inches)	Cost (cents)
Homespun	40	40
Friar's cloth	50	75
Monk's cloth	50	90

Lumber	
For cases, cabinets, and other furniture (when packing boxes are not available)	3 to 7 cents a foot

Scraper	
For scraping old paint, furniture, and the like	5 cents

Blackboards	
Slate, per square foot	$0.18 to $0.23
Hypoplate, per square yard	1.25
Triple board, various sizes	1.50 to 8.00

Pictures

Color prints (lithographs, large size)	$1.50 up
Photographs (wall pictures)	1.00 up
Japanese prints	.25 up

The following are reliable picture firms:

Color prints

American Art Extension, Chautauqua, New York
Atkinson, Mentzer & Co. (Rhine Prints), 34th Street, New York City
R. Voigtlanders Verlan, Leipzig, Germany
Asher & Co., 14 Medford Street, Convent Garden, London, W. C., England
B. G. Teubner, Leipzig, Germany
Emery School Art Company, 372 Boylston Street, Boston, Massachusetts
University Art Shop, 1604–1606 Chicago Avenue, Evanston, Illinois
Eugene Verneau (Rivière Prints), 108 Rue de la Folie, Mericourts, Paris, France
G. Bell & Sons, Limited, York House, Portugal Street, London
Ritter and Flebe, Boston, Massachusetts

Photographs (wall pictures)

Curtis and Cameron (Copley Prints), Boston, Massachusetts
Berlin Photographic Company, 305 Madison Avenue, New York City
Emery School Art Company, 372 Boylston Street, Boston, Massachusetts
Chicago Art Education Company, 336–338 West 63d Street, Chicago
A. W. Elson & Co., 146 Oliver Street, Boston, Massachusetts
Hoover Art Company, Hollywood Station, Los Angeles, California

Taber-Prang Art Company, Springfield, Massachusetts
Doubleday-Page Art Company, Springfield, Massachusetts
Horace K. Turner Company, Oak Hill, Newton Center, Boston
Maison Ad. Braun, 13 West 46th Street, New York City
Prang Company, Knickerbocker Trust Building, Fifth Avenue, New York City
W. A. Mansell & Co., 405 Oxford Street, London, England
Frederick Hollyer, 9 Penbroke Square, London, W., England
E. A. Seeman, Leipzig, Germany
School Arts Publishing Company, 120 Boylston Street, Boston, Massachusetts

Japanese prints

E. T. Shima, 20 East 33d Street, New York City
Matsumoto, Do., Tokyo, Japan, Dept. 114

Casts

Busts range according to size from	$1.00 to $50.00
Statues range according to size from	1.50 to 50.00
Reliefs range according to size from	1.00 to 50.00

The following are reliable cast firms:

C. Hennecke Company, Milwaukee, Wisconsin
Boston Sculpture Company, Melrose, Massachusetts
P. P. Caproni & Brother, 1914–1920 Washington Street, Boston
G. Lucchesi & Co., 113 East 34th Street, New York City

APPROXIMATE ESTIMATE FOR COST OF DECORATING ROOM

The following are approximate estimates for the actual cost of materials for decorating a plastered room 23 x 28 x 12 feet, exclusive of teacher's desk, pupils' desks, heater, and blackboards, the room containing four windows and two doors:

Ceiling	644 square feet
Wall space (above and below blackboard, which extends around room)	832 square feet
Total	1476 square feet

Amount of paint needed (300 square feet to a gallon)	5 gallons
Cost of paint (water)	$1.50 to $ 2.00
Cost of paint (oil)	7.00 to 10.00
Stain for woodwork (blackboard frame, doors, windows, and the like)	.75 to 1.50
Bookshelves (height 5 feet, width 4 feet, depth 10 inches) 5 shelves and stain	.85 to 2.00

Water cooler (faucet) 1½ gallon to 5 gallons	$1.20 to	$2.50
Water cooler (bubbling cup) 5 gallons to 10 gallons	6.75 to	7.50
Stand for cooler — wood and stain	.50 to	1.00
Shades — four windows (roller)	1.20 to	2.40
Curtains — four windows	.32 to	1.46
Curtain rods — four windows	.20 to	.80
Pictures — four foreign lithographs	6.00 to	8.00
four photographs	8.00 to	20.00
Picture frames	2.00 to	20.00

Totals $14.52 to $41.66 (water paints, faucet cooler, lithographs)
$27.57 to $66.66 (oil paints, bubbling cup, photographs)

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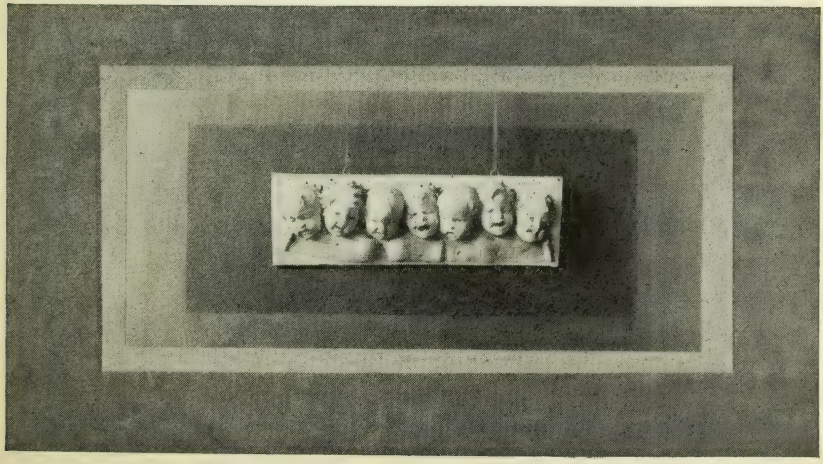


There was a child went forth every day;
And the first object he looked upon, that object he became;
And that object became a part of him for the day, or a
certain part of the day, or for many years, or stretching cycles of years.
The early lilacs became a part of this child,
And the grass, and the white and red morning-glories, and
the white and red clover, and the song of the phoebe-bird,
And the third-month lambs, and the sow's pink-faint litter,
and the mare's foal, and the cow's calf,
And the noisy brood of the barn-yard * * * *
And the apple-trees covered with blossoms, and the fruit
afterward, and wood-berries, and the commonest weeds
by the road; * * * *
And the school-mistress that pass'd on her way to the
school, * * * *
The village on the highland seen from afar at sunset — the
river between.
Shadows, aureola, and mist, the light falling on roofs, and
gables of white or brown, three miles off, * * * *
These became a part of that child who went forth every
day, and who now goes, and will always go forth
every day.

WALT WHITMAN

Cornell Rural School Leaflet

FOR TEACHERS

Published by the Department of Rural Education, New York State College of Agriculture at Cornell University, B. T. Galloway, Director. Entered as second-class matter at the post office at Ithaca, New York

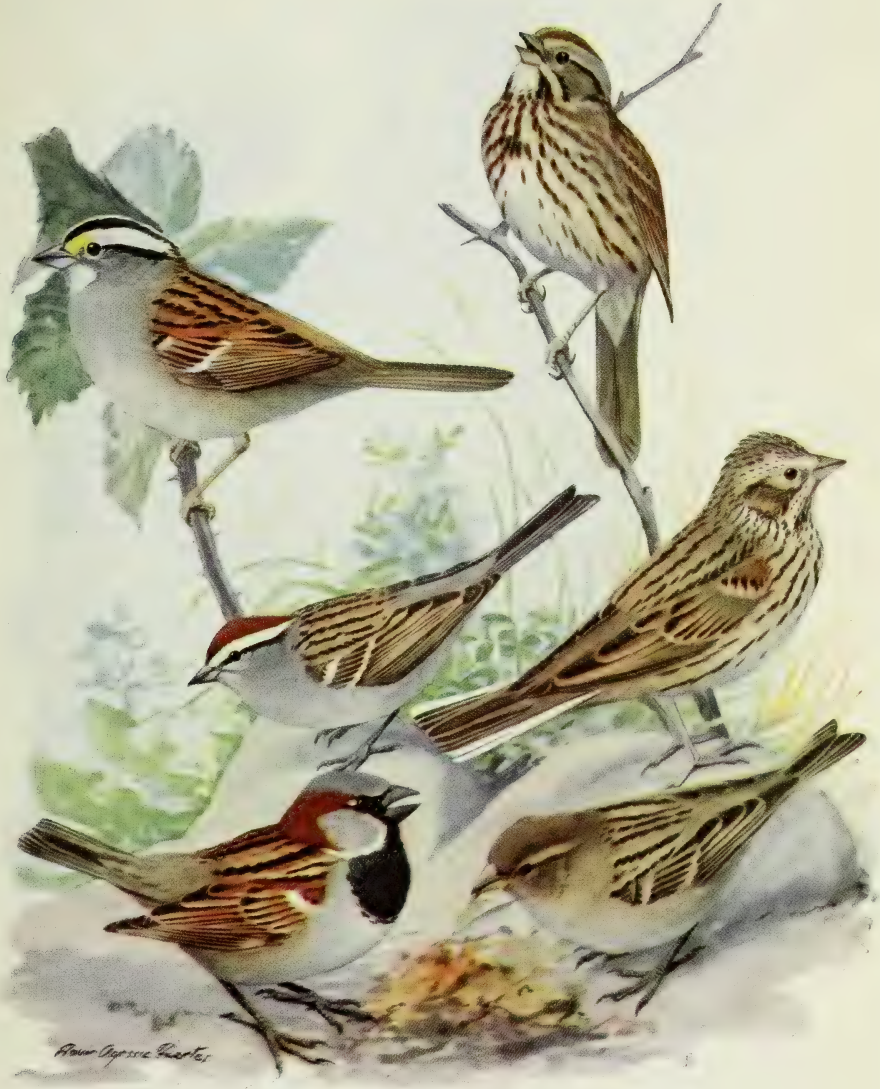
ALICE G. McCLOSKEY and EDWARD M. TUTTLE, Editors

ARTHUR D. DEAN, W. E. PIERCE, G. F. WARREN, and C. H. TUCK, Advisers

Vol. 8 ITHACA, NEW YORK, SEPTEMBER, 1914 No. 1

PHOTOGRAPH BY VERNE MORTON

SUBJECT MATTER
IN
NATURE STUDY AND ELEMENTARY AGRICULTURE
FOR 1914-1915
AS OUTLINED IN THE
NEW YORK STATE SYLLABUS
FOR
ELEMENTARY SCHOOLS



FIVE COMMON SPARROWS

WHITE-THROATED SPARROW SONG SPARROW
CHIPPING SPARROW VESPER SPARROW
HOUSE, OR ENGLISH, SPARROW
MALE AND FEMALE

LIBRARY
OF THE
UNIVERSITY OF ILLINOIS

THE VESPER SPARROW[1]

EDITH M. THOMAS

It comes from childhood land,
    Where summer days are long
And summer eves are bland,—
    A lulling good-night song.

Upon a pasture stone,
    Against the fading west,
A small bird sings alone,
    Then dives and finds its nest.

The evening star has heard,
    And flutters into sight;
O childhood's vesper-bird,
    My heart calls back, Good-Night.

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[1] Reprinted by courtesy of Houghton Mifflin Company.

FOREWORD

THE EDITORS

The purpose of this number of the Cornell Rural School Leaflet is to give to the teachers of New York State accurate subject matter that may be useful in teaching nature study and elementary agriculture as outlined in the New York State Syllabus for the year 1914–1915. No teacher is expected to make use of all the material presented in the following pages; but according to the ages of the boys and girls and the amount of interest and inspiration that a teacher has in the subjects, a selection from the articles may be made. The various topics are presented by specialists who, from a large field of knowledge, have given what they consider important in their lines of work in the education of children.

The leaflet is made up of two parts. In Part I will be found subject matter that will be helpful in teaching nature study and elementary agriculture as outlined in the syllabus. In Part II we have given some material that will doubtless be suggestive to many of our rural teachers who have special interest in outdoor study.

In order to make the country-life instruction in our public schools of greatest value, the following should be considered:

1. Nature study is the study of nature. Every boy and girl should be encouraged to find education and resources in the out-of-doors. They should know the wild life about them — the birds, the flowers, the weeds, the insects, the animals of field and wood. They should take interest in the soils, the rocks, the brooks, the hills, the woodlot, the forest. They should learn to love the music of the wind, the soughing of the pines, the clear, true starlights, the restfulness of rains, and the magic of the snows.

2. Agriculture is a dignified industry that, for its greatest development, must be founded on science. Boys and girls even in the elementary grades should be taught to seek the truth in all that has to do with farm experiences and practices, and to turn to scientists for information that relates to farm problems. They should know who are investigators along the many lines of scientific agriculture in state and national institutions, and why they have the right to receive help from these persons.

3. Agriculture should not be taught from a printed page. The boys and girls should enter during each school year some agricultural activity, such as the making of a school or home garden, an agricultural contest, an exhibition of farm products, the planting of school grounds, or the like. Books and bulletins may be used for reference and suggestion, but the real education in this work will result from actual experience in the out-of-doors. The school enterprise must be planned in such a way

that it will appeal to the young folk as important. Farm boys and girls are not much interested in doll gardens on the school grounds.

In country districts there is much need of a home garden on the farm, and the boys and girls should take care of this. Fresh garden vegetables for the home table will contribute to the well-being of the family. The teacher who encourages this effort is doing a fundamental work in a community. There is need for a home fruit-garden. An interesting work would be to find out the most desirable variety of grape for the locality and teach the children how to procure and plant a cutting. The boys and girls, with a little help and the interest of the teacher, can do much in raising poultry.

This year we intend to keep as close a record as possible of accomplishment in country-life work in our rural schools. We shall make report of such accomplishment, that each district may profit by the experiences of others, and also that the patrons of rural schools may, by reading such records, realize the importance of this educational work and help teachers to further it in every way. We hope, therefore, that all teachers in country districts may help us to present the work of New York State along country-life lines in as complete and accurate a way as possible. Have in mind a few underlying ideas in presenting your report, as follows:

1. *The opportunity for country-life education in your district*
2. *Cooperation of parents; meeting at schoolhouse in order to secure this*
3. *Specific work undertaken; results*
4. *Accomplishment in nature study*
5. *Accomplishment in elementary agriculture*
6. *Agricultural competitions*
7. *Agricultural exhibits*
8. *The introduction into the home gardens of your district of some desirable variety of fruit, such as a better pome fruit, grape, or the like, or of some vegetable not ordinarily grown*

PART I

LIST OF SUBJECTS FOR 1914–1915

IN NATURE STUDY AND ELEMENTARY AGRICULTURE AS OUTLINED IN THE NEW YORK STATE SYLLABUS

BIRDS

For special study, the English sparrow and the hen[2]; to be recognized, any two of the winter birds, and any five of the following: canary, song sparrow, robin, bluebird, duck, goose, heron.

ANIMALS

For special study, the dog and the cow[2]; to be recognized, horse,[3] cat, mouse, rabbit, squirrel.

PLANTS

For special study, the pea[4]; to be recognized, one of the clovers, one of the grains, one of the grasses, and any six of the following: geranium, hepatica, strawberry, apple, goldenrod, bluet, columbine, lettuce, onion, bloodroot; also the following weeds: Canada thistle, wild mustard, orange hawkweed ("paint brush"), wild carrot, long-leaved plantain.

INSECTS

For special study, the grasshopper or the cricket, and one biting and one sucking insect[5]; to be recognized, any four of the following: grasshopper, mosquito, mourning cloak, tent caterpillar, ant, bumblebee.

TREES

For special study, the maple; to be recognized, the hemlock or the pine, and any five of the following: apple, plum, beech, elm, locust, birch, chestnut, cedar.

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[2] If the leaflet for September, 1913, giving lessons on the hen and practical instruction in poultry-raising, and lessons on the cow and in practical dairy work, is not in the school building, teachers should make application for it to the Department of Rural Education, New York State College of Agriculture, Ithaca, New York.

[3] Although the horse is not given for special study this year, its importance has led us to publish material that some teachers may care to use. (See page 73.)

[4] Since the pea is given for special study, it seemed advisable to connect it with the legume family, which is very important for human food and for stock food. (See page 102.)

[5] On pages 138 to 152 we have given subject matter on several biting and sucking insects from which the teacher may make selection.

BIRD STUDY

THE EDITORS

A junco ready for dinner

Before beginning the study of birds for 1914–1915, we wish that teachers would go over the material in this publication and make simple plans for the year's work, both as to method of instruction and as to results to be accomplished. By this we do not mean to have outlines made to be followed by the children, for nature study is the study of nature and should be largely spontaneous. Instead of following outlines in bird study, let us follow the birds. It is very important, however, for the teacher to decide what will be most helpful in leading the boys and girls to make observations that are worth while.

We would suggest that no one should plan to do too much. Consider the following suggestions carefully, and perhaps you may be able to use one or more of them to make a good beginning in your outdoor teaching.

1. As you read over the articles on birds in this leaflet, prepare a notebook for yourself in which you record some things that you will be able to work out with the boys and girls. During your reading you will get a fairly good knowledge of the possibilities of educational work connected with the birds for study this year. You may not know these birds, but when your interest is once aroused the knowledge comes easily and rapidly. Some teachers have known only a few of the commonest birds, such as the robin, the crow, and the like, at the beginning of the school year; but with the aid of the children they have become familiar with twenty-five, thirty, and even a larger number before the close of the spring term.

2. Make a list of the birds given for this year's work that you do not know. Try to get some information about these birds, so that if you should come across one of them you would recognize it. Encourage the boys and girls to help.

3. Have a canary at school some day. Caged birds are most unsatisfactory to any one who has associated with birds in the open, and from the experience with the canary an interest in leaving the birds free, and yet having their companionship, can be encouraged. Any stories that you know of the experiences of bird lovers with wild birds will be valuable. Often some of the shy birds will respond to human kindness and become very friendly. (See page 1294)

4. The boys and girls will take an interest in making bird houses. At least one should be placed in every school yard in New York State. Some of the most attractive birds, such as the bluebird, wren, and purple martin, will build in houses.

5. The children should have knowledge of the economic importance of birds, and a study of the feeding habits will help in this. They should be taught to feed the birds during the winter. (See page 12.)

6. A collection of old nests always has an interest for the children, and much can be learned from them. The care with which some of the nests are made, the materials that are used, and the like, increase observation as the children study them. Many collections of nests were sent to the State College of Agriculture for the exhibition held during Farmers' Week. In giving the description of birds' nests for identification, the following points as prepared by Doctor Allen should always be considered:

Size: a. Diameter, inside and outside
  b. Depth, inside and outside
Material: a. Outside
  b. Inside (lining)
  c. In some nests, as the robin's, there is a middle layer; this also should be described

Bird boxes exhibited by young architects

Location: a. General environment — woods, hedgerow, orchard, and the like
b. Name of tree or bush in which placed, as apple tree
c. Location in tree or bush, as end of branch, near trunk, and the like
d. Height above ground

7. A few birds seem to be exceedingly destructive in some localities; even the robin has a very bad reputation in one or two sections of New York State. If this is the case in your community, why not start the children making some investigations before the birds are destroyed, and let them take up the matter with Doctor Allen, of the Department of Extension Teaching at Cornell University? He will be glad to help them estimate the destruction, and will be able to advise what it is best to do in the matter. We want the children to learn to turn to scientists for information and advice on a question as important as the destruction of wild life.

8. In the study of birds, as in all nature study, avoid having lessons learned from a book. It is far better to have a few facts first-hand from nature than to know what another person has written about a bird. When the initial study has been made by observations in the out-of-doors, the boys and girls may be taught to find answers to their questions in reference books. Every schoolroom should have one good bird book. Perhaps there is no inexpensive publication more useful than Reed's *Bird Guide*, published by Doubleday, Page & Co., Garden City, New York (price $1).

9. The winter birds will give the best opportunity to prepare for the spring migration. The birds' Christmas tree or a feeding station near the school will attract many birds, and the children will enjoy watching them. When winter birds appear that you do not know, have the boys and girls work with you to describe them so that we can identify them for you. The description should give the following: (a) size, whether larger or smaller than an English sparrow, robin, or crow; (b) general color above and below; (c) specific color markings; (d) kind of bill and feet, if possible; (e) any peculiarity as to note or flight; (f) when and where seen.

10. In the spring as the birds return, the preparation of a bird calendar is a very interesting and instructive piece of work. The calendar may be prepared by the pupils and should show the name of the bird, the date on which it was seen, and, if desirable, the name of the person who saw it. If bird calendars are kept accurately and preserved from year to year, they will serve as a valuable record of the migrations for the locality. Most persons are familiar with but few of the commonest birds, and a bird calendar will stimulate observation which will lead to the identification of the shyer birds that are more rarely seen, and of those that are not resident but pass through in migration. When we stop to consider

that probably one hundred and fifty different species of birds may be observed in any part of New York State during the course of a year, it is apparent that the average person is familiar with a very small proportion of them. The boys and girls will be interested to increase their knowledge and to add to the bird calendar in order to make it more complete each year. A migratory table that will help in the work follows:

PARTIAL LIST OF BIRDS COMPRISING THE SPRING MIGRATION[6]

(Until April 30 — approximately)

Date of arrival	
February 15 to March 10	Purple grackle
	Rusty grackle
	Red-winged blackbird
	Robin
	Bluebird
March 10 to 20	Woodcock
	Phœbe
	Meadow lark
	Cowbird
	Fox sparrow
March 20 to 31	Wilson's snipe
	Kingfisher
	Mourning dove
	Swamp sparrow
	Field sparrow
April 1 to 10	Great blue heron
	Purple finch
	Vesper sparrow
	Savanna sparrow
	Chipping sparrow
	Tree swallow
	Myrtle warbler
	American pipit
	Hermit thrush
April 10 to 20	Yellow-bellied sapsucker
	Barn swallow
	Yellow palm warbler
	Pine warbler
	Louisiana water thrush
	Ruby-crowned kinglet
	Green heron
April 20 to 30	Spotted sandpiper
	Whippoorwill
	Chimney swift
	Least flycatcher
	Purple martin
	Towhee
	Black-and-white warbler
	Bank swallow
	Ovenbird
	House wren
	Brown thrasher
	Catbird
	Wood thrush

For special study this year, the house (English) sparrow and the hen are given. In the following pages will be found material that may be helpful in teaching boys and girls to know the house sparrow and also some of the other sparrows. During the past four years we have published many lessons in the interest of poultry. Doubtless most teachers will have these lessons, but if they are not available we will send them on application.

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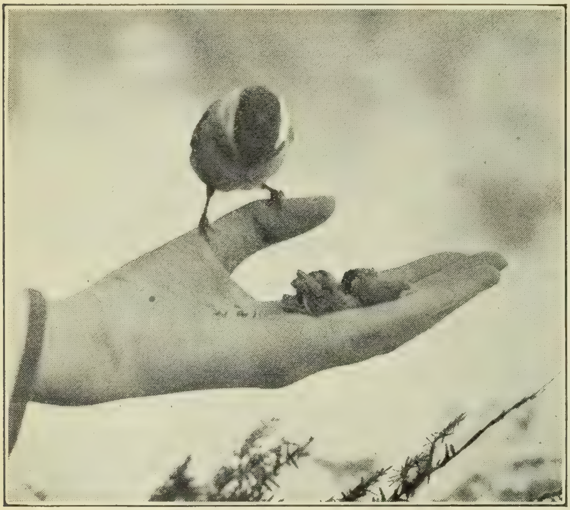
[6] Chapman, Frank M. Handbook of Birds of Eastern North America.

HOW TO ATTRACT WILD BIRDS

Arthur A. Allen

Would you like to have a live wild bird come and feed from your hand? Would you like to stand at your schoolroom window with the children and have a whole flock of wild birds feeding on the window sill? Would you like to feel that you are helping to keep at least a few small birds from starving to death through the long, cold winter? Then follow these directions, and if your efforts do not meet with success at first have a little patience, and a wealth of pleasure is in store for you and your pupils.

When to begin.— Do not wait until the ground is covered with snow before any plans are made to attract the birds; begin now, or at least before the middle of November, and you will succeed in keeping more birds than might otherwise stay.



A chickadee ready for luncheon

What food to use.—Our winter birds are of two kinds — seed-eaters and insect-eaters. The seed-eaters that may be expected to come to a feeding shelf are the tree sparrow, song sparrow, junco, redpoll, pine siskin, crossbill, pine and evening grosbeaks. Horned larks and snow buntings prefer to feed in the open, but they can be attracted to spaces in the school yard by scattering seed on the ground. For seed-eating birds good foods to use are cracked corn, buckwheat, hemp, millet, and sunflower seed; or, better still, mixed chicken feed such as is sold for young chicks, sweepings from a near-by mill, or hayseed from the barn floor. The insect-eaters are the woodpeckers (downy and hairy in all parts of the State, with the flicker, red-headed, and red-bellied, in the southern counties), nuthatches, chickadees, and brown creepers. The woodpeckers find their natural food by drilling into the chambers of wood-boring larvæ; the others find hibernating insects, pupæ, or eggs in the crevices of the bark. All of them, however, are very fond of beef suet, and once they have found a piece fastened in the tree they will return to it again and again until it is all gone. Sunflower seeds and crumbs of raw peanuts are preferred by chickadees and nuthatches to any other food, but these are not always easily obtainable and the suet is a good substitute.

Where to place the food.— Do not expect the birds to be tame at first, or to come immediately to the window sill. One of the greatest pleasures to be derived from feeding the birds is to watch the gradual loss of timidity and the increase in confidence of the birds that come regularly to feed. At first they will be as wild as any birds of the woods, but gradually, as they find themselves safe and unmolested, they will respond to kindness. When a new bird arrives among the regular visitors, he is always noticeably more timid than the others, and sometimes remains shy for several days.

In placing the food it is well to bear in mind that eventually you want all the birds coming to one place, either to a shelf at the window sill or about the flagpole, where it will be easy to watch them. It will be well first to select the place where you wish them to come, whether you immediately build the shelf or not. Then, from this as a center, place the food along radiating lines to a considerable distance from the school. The more pieces of suet put up, the more quickly the birds will find it and the sooner they will come to the window sill. It is necessary for only one bird to find one piece of suet in order to eventually have a considerable troop coming regularly, for birds are ever on the alert watching their fellows as well as searching for food on their own account. When one bird finds the suet, the others will see him and soon follow. It is better to begin by attracting the chickadees. They respond more quickly and the other birds seem to follow them about in their search for food, either for the sake of their company, or, more probably, to take advantage of their active habits and keen sight in locating spots where food is abundant.

Nuthatch at the feeding station

At first it will be necessary only to tie the pieces of suet to the branches without protection of any kind, and the more conspicuous the places selected, the better. Later, if there are many squirrels, or crows, or house sparrows about, it will be more economical to move the suet to the trunk of the tree, holding it in place by a piece of fine wire chicken netting (one half inch) through which the smaller birds can peck. This precaution will keep squirrels and crows from carrying the suet away in one piece. The house sparrows, moreover, seldom care to cling with their feet to the vertical trunk while feeding, although the native birds find this the most natural and easiest way. Another method is to suspend from the outer branches, by strings, small wire baskets filled with suet. These baskets can easily be made by a small boy from an ordinary piece of wire, as the size and shape are not important. Wire egg-baskets, soap-shakers, and the like can be used, if one does not care to make his own receptacles. Instead of using wire, some persons prefer to use a bag knitted from string and of coarse enough mesh so that the birds can easily peck through it. Making these bags would be good handwork for the girls.

The feeding shelf.— As soon as any of the birds have been seen eating the pieces of suet, it is time to put up the feeding shelf. This should be placed at a window on the sheltered side of the school (usually the south), showing preference to the one nearest to a tree. If the window sill is very broad, it will be sufficient to nail a cleat along the outer edge to keep the food from blowing off. Usually, however, it is more satisfactory to fasten a board eight to twelve inches wide to the sill to act as a shelf. It may be made the entire length of the window sill or only a part; but the larger it is, the more birds will feed together, as our native birds all want plenty of " elbow room " while they are feeding. A narrow strip should be fastened to the end of the shelf to keep the food from blowing off. At the westerly end a small evergreen tree or a large branch should be fastened. This offers shelter to the birds and proves as attractive as the food itself. It may be nailed to the window casing, or a hole may be bored in the shelf to hold it. It should be as large as can be conveniently held in place.

In case there is not a suitable window sill for the shelf, the suggestion of Mabel Osgood Wright for a flagpole feeding-shelf may prove even more satisfactory. We quote the following:

" Every school has a flagpole, and while some are fastened to the building itself, many stand free and are planted in the yard.

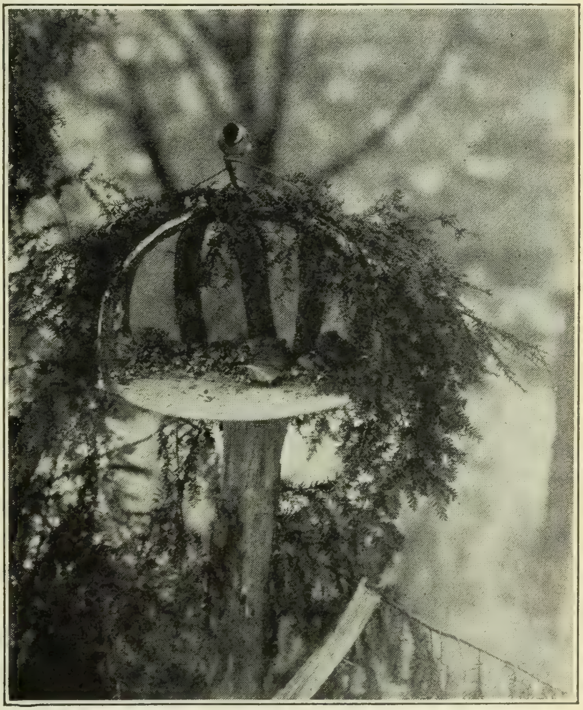
" Around this pole a square or circular shelf about eight inches wide can be fastened, four feet from the ground, and edged with a strip of beading, barrel hoops, or the like. A dozen tenpenny nails should be driven on the outside edge at intervals, like the spokes to a wheel, and the whole neatly painted to match the pole.

" Then, each week one child should be appointed as bird steward, his or her duties being to collect the scraps after the noon dinner hour and place them neatly on the counter, the crusts and crumbs on the shelf and the meat to be hung on the spikes.

"Nothing will come amiss — pine cones, beechnuts, the shells of hard-boiled eggs broken fine, apple cores, half cleaned nuts; and if the children will tell their parents of the counter, they will often put an extra scrap or so in the dinner pail to help the feast. Or the fortunate children whose fathers keep the market, the grocery store, or the mill may be able to obtain enough of the wastage to leave an extra supply on Friday, so that the little pensioners need not go hungry over Sunday.

"All the while the flag will wave gaily above the little Citizen Bird, as under its protection he feeds upon his human brother's bounty."

Once the birds have found the suet in the trees, those pieces farthest from the feeding shelf should not be replenished or should be brought closer and closer until the birds have found the shelf. When the shelf has been found, there is no further need for the suet in the trees, and efforts should be concentrated in keeping a bounteous supply of food always ready on the shelf.



The feeding station described on this page. Chickadee waiting for junco to finish

The author has personally had the greatest success in establishing feeding stations by imitating natural conditions as nearly as possible. In the absence of trees about the spot where it was most convenient to watch, a large discarded Christmas tree was erected, and about its base was thrown a pile of brush. Close by a log was placed standing on end, to resemble a dead tree for the woodpeckers. A shorter log was capped with the top of a barrel, and protected from the weather by a hood improvised from barrel hoops and a piece of cotton cloth. On the ground was laid a decaying log slightly hollowed to hold seed.

From time to time the station was supplied with food, and the birds found rich stores. Pieces of suet were fastened to the standing log, or rammed into holes bored in its sides. Bread, cake, and doughnut crumbs, small pieces of suet, and mixed chicken feed cracked fine, were kept beneath the hood, and similar food was placed on the ground log. The feeding station was only about twenty-five feet from the back door, yet it proved a veritable paradise for the birds, not only during the winter months when the ground was covered with snow, but throughout the year. During the past spring, for instance, a flock of eleven of the rare evening grosbeaks paid daily visits from the first of April until the middle of May, remaining for nearly a month after the time they usually leave for the North. As I write this (the twenty-first day of May), chickadees, downy and hairy woodpeckers, and catbirds are tasting of the suet; while song sparrows, white-throated sparrows, chipping sparrows, and cowbirds are scratching among the seeds. Of course there are house sparrows, many of them; but they do not bother the other birds so long as I provide plenty of food. I feel that I can afford to feed them because their chirping attracts other birds to the feast, and I have many more as a result. As for driving the other birds away my fears have proved groundless, for next to the chickadees the house sparrow has shown himself the biggest coward of the lot, and I have frequently seen a whole flock put to rout by a single nuthatch.

A hairy woodpecker enjoying the suet on the window casing

Whatever type of feeding station is decided on, two things should always be borne in mind: first, once the birds have come to depend on the food supplied, it should not be discontinued for even a few days during the winter when other food is scarce, for they might starve as a result; second, the birds need shelter as well as food, shelter from the weather and from their natural enemies. The Christmas tree at one

Tree sparrow at a window feeding-shelf end of the shelf does very well to shelter the birds while they are feeding; but if there are no thick trees nor brush piles in the near vicinity into which they can disappear at the approach of a hawk, some such shelter should be created five to thirty feet from the feeding station. This can be done by erecting a tepee of poles and evergreen boughs, or by bringing in a pile of brush. Moreover, this will prove a great incentive to the birds to come to the window, as they will hesitate to fly long distances through the open even in order to get to food. If there are no trees at all in the vicinity of the school, it may be necessary to establish a series of these shelters every fifty feet to the nearest trees. If properly arranged with evergreen boughs there is no need of their being unsightly. An admirable birds' tepee can be made of the poles used for lima beans with the vines attached. This is also a good way of storing the poles over winter. The need of these shelters will be emphasized if there are hawks about. Only yesterday a sharp-shinned hawk swooped down at the birds feeding at my station and made an attempt to catch them. He was unsuccessful only because of the brush pile into which they all darted at his approach.

As many chickadees, nuthatches, and woodpeckers as I have ever seen at a feeding station were assembled at one maintained on a balcony. There was but one tree within five hundred feet, and the only shelter afforded was the evergreen boughs and the dead stub of a tree brought in and erected at one corner of the balcony. Do not think, therefore, that your school is too unfavorably located to attract the birds. If you have never tried it, you little know what pleasure is in store for you.

In midwinter. A chickadee having an acceptable meal

THE FOOD OF BIRDS

ARTHUR A. ALLEN

The various phases of bird study are many and diverting: the mysterious migrations, the bright plumages, the charming songs, the nests and eggs. It is seldom that we succeed in tearing ourselves away from these and concentrating our thoughts on the more serious consideration of the bird's place in nature and the economy of bird life. When we do come to a realization of the valuable part the birds play in our own lives, we are inspired to even greater interest to learn all we can about them, to care for them, and to protect them. So immediate are their services, even so near to our purse strings, that we wonder how a true realization of their value could have been so long overlooked. It seems impossible that but a few years ago many of our most beneficial birds were actually considered enemies to our agricultural interests and a bounty was placed on their heads. Such was the price of ignorance. Thousands of valuable birds were killed before the harm that was being done was realized. And then it was too late! Scourges of insects and rodents swept over the country, causing losses of millions of dollars.

Let us consider for a moment the position allowed the birds in this country. Before its discovery and settlement and civilization by the white man, when nature was allowed to take her own course and settle her own difficulties, insect plagues of any kind were probably of very rare occurrence. The insects which to-day in countless hordes annually damage the crops to the extent of millions of dollars were kept down to normal numbers by their natural enemies, chief among which were the birds. If at any place there was an undue increase of insects, it meant to the birds food more easily secured and they flocked to the spot; and soon the insects disappeared. There always existed this balance of nature. An increase in the abundance of any plant meant an increase in the number of insects feeding on that plant, and a corresponding increase in the birds feeding on these insects. Were we to follow it still further, we should find also an increase in the number of hawks and predaceous animals feeding on the birds; for in every locality every species of animal, if undisturbed, tends to increase to the limit of its food supply.

Then the white man came to this country, cutting down the forests, planting grain, introducing new plants, and disturbing the balance of nature generally. Large fields of corn and wheat meant increased food supply for locusts, wireworms, cutworms, and the like, which formerly, between death by the birds and starvation, had been living a precarious existence. Naturally there followed a great increase in their numbers. Discovering this, the birds soon flocked to these fields where they found such an abundance of insect food. The settlers, ignorant of the habits of these birds and thinking they had come solely to feed on the grain, did their utmost to kill them off and frighten them away. Without the birds to check them, such an increase of the insect pests occurred that in places the settlers were forced for a time almost to give up the cultivation of grain. Forbush[7] says: "In 1749, after a great destruction among the crows and blackbirds for a reward of three pence per dozen, the Northern States experienced a complete loss of their grass and grain crops. The colonists were obliged to import hay from England to feed their cattle." Again, "The greatest losses from the ravages of the Rocky Mountain locust were coincident with or followed soon after the destruction by the people of countless thousands of blackbirds, prairie chickens, quail, upland plover, curlew, and other birds." Similar ravages by insects following the destruction of birds have been noticed all over the world for centuries.

When the balance of nature has once been disturbed, it is always difficult to restore. Since our agricultural progress means increased and increasing food supply for the insect pests, we must expect a corresponding increase in their number, and if we would harvest all of the yield we must provide a means for keeping them in check. Natural means have seemed insufficient, so we have invented artificial methods for their destruction. We poison our seed, we spray poison on the leaves and branches, we fumigate whole orchards, we even gather the insects by hand, spending millions and millions of dollars annually and yet without avail. Locusts destroy our wheat, wireworms destroy our corn, caterpillars destroy our trees and rob us of our fruit in spite of all we can do; yet, in all this work of protection, we tend to overlook our most valuable allies, the birds. So quietly their work goes on that many people live and die without appreciating anything but their beautiful feathers. True, at times, so striking has been the protection given by the birds that even the dullest could not overlook it. In 1848, after the first year's crops had been entirely destroyed in Utah by the myriads of crickets that came down from the mountains, and the second year's crops were rapidly disappearing, the settlers were saved from actual starvation by the thousands of gulls that descended on the fields and devoured the crickets. It was looked upon as a heaven-sent miracle, and during the past year (1913) a beautiful monument was erected in Salt Lake City "to the gulls that saved the first settlers from famine." As a matter of fact, many such instances of the help given by birds could be cited. It was but the same process which is going on about us every day of the year and of which we do not realize the value until for some reason it is checked and we are overwhelmed with insects.

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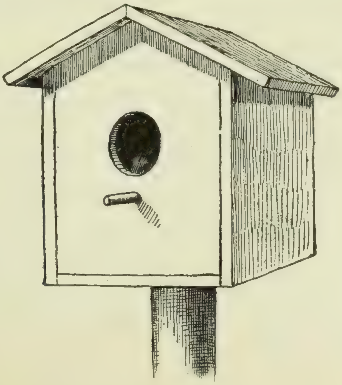
[7] Forbush, E. H. Useful Birds and Their Protection.

Nor is it from insects alone that our crops have suffered and again been protected by the birds. Among new plants introduced into this country, some were brought in, through either mistake or ignorance, that soon got beyond the control of the colonists. Finding conditions here so much more favorable to their growth than those in the old country, they spread rapidly, soon became obnoxious, and to-day are known as weeds. But, rapidly as these have spread and become a menace to our agriculture, it is not a circumstance to what would have happened or still would happen were we to drive away the birds. Think of the hundreds, or even thousands, of seeds produced by each plant. What would happen if all were to grow and reproduce themselves? But as long as we have the birds, we need feel little danger. Our sparrows, together with many other birds, are primarily seed-eaters, and many live almost altogether on the seeds of weeds. From the stomach of a single bob-white, Doctor Judd took five thousand seeds of pigeon grass. If this represented a single meal of one bird, we can readily understand why our weeds are no worse than they are.

The hawks and the owls have perhaps been persecuted more than any others of our native birds because of their occasional visits to the poultry yard; yet were it not for these birds we should be so overrun with mice and other small mammals that life would be unendurable. History is full of accounts of mouse plagues that have finally been conquered by large flights of owls. In certain localities of New England to-day, in large part owing to the scarcity of hawks and owls, field mice have become so abundant that young fruit trees cannot be grown unless protected from them by artificial means. In sections of the West, partly because of the destruction of hawks and owls, jack rabbits and gophers have become so abundant that organized efforts have to be made to destroy them. In Pennsylvania some years ago the thousands of dollars paid for bounties on the heads of hawks and owls was but a trifle as compared to the cost of the ravages of the rodents following their destruction. It is only in comparatively recent years that we have come to realize that all birds are our friends. True, in our introduction of poultry, we have greatly increased the available food supply of certain of the birds of prey, and it is natural that they should take advantage of it. The toll they levy on our poultry yards, however, is but little compared with their value in keeping down the number of weasels and small rodents.

Laying aside, then, all æsthetic reasons, which in themselves should be sufficient, we ought to protect all of our birds, not only for their indirect but for their immediate influence on our personal welfare. This is true not only for the farmers, but also for those living in the villages and cities. Wherever there are trees or gardens to be protected from insects and weeds, the birds are our best friends. Books have been written, filled with certified instances of birds having prevented invasions of aphids, caterpillars, potato beetles, cutworms, white grubs, and pests innumerable.

Enough has been said, however, to convince us of the actual value of the birds. Now what are we to do? What is the legacy that we are to leave to future generations? In the first place, we must counteract what has been done in past years in frightening away the birds. We must call them back to haunts from which they have long since been driven, and do what we can to overcome the fear that has been instilled into them. It is true that wild birds respond to kindness, and where dangers have been removed some of the most timid have been found to become as tame as domestic fowls. When their sense of fear has been allayed, they will flock to our habitations in order to destroy insect invasions even as they now flock to similar invasions in the wilds. But it means a long, hard fight to overcome the dreadful work of many years. The coming generations must be educated to the knowledge that birds have a better use than as targets for sling shot and gun, that they have greater value than as meat for the potpie or as decoration for women's hats; that especially about our homes should they be encouraged and protected; that a bit of suet in the tree or some seeds on the snow may mean a troop of watchful little guards about our orchard all winter; that the removal of a few stray cats and the proper care of our pets is our just duty; that a few bird houses about the house and garden for bluebirds and wrens will do more to keep down insects than can many a gardener; that woodlots and thickets about the farm are as necessary as high fences; that bushes and trees about the house and garden for the protection of the birds are as necessary as laws; that the planting of wild fruit for the birds will save our cultivated trees. These and many other things must be taught to the coming generation.



SPARROWS

ARTHUR A. ALLEN

This year the English sparrow, or house sparrow as it is more correctly called, is the bird for special study. The frontispiece illustrates four of our commoner native sparrows grouped with it. In color the sparrows are mostly dull and inconspicuous, and for that reason are difficult to identify. The purpose of the following articles is to simplify this identification as far as possible.

The sparrow family is the largest family of birds, including about twelve hundred species and subspecies, and is represented in all parts of the world except Australia and the adjacent islands. The true sparrows are mostly dull-colored, but the family includes the grosbeaks and the buntings, some of which have very brilliant plumage. Many species take high rank as songsters, and some of the favorite cage birds, such as the canary and the linnet, belong to this family.

The family is now rather generally conceded to represent the most highly developed type of bird, and, though showing considerable variation in color and habits, the birds do not vary greatly in size and are all alike in possessing stout conical bills for crushing seeds. The bills are very sharply pointed, however, and most species feed largely on insects during the summer months. Because of their seed-eating habit, many species are able to find food in the North during the winter months, and several are among our common winter birds. For this reason they are of great economic importance in destroying the seeds of weeds. It has been estimated that in the State of Iowa a single species, the tree sparrow, destroys eight hundred and ninety-five tons of weed seed each winter.

Using the name "sparrow" in the restricted sense, as applying to the dull-colored, streaked sparrows, which are largely terrestrial in their habits, there are fifteen species that occur regularly in New York State. Three of these are rare or local and not likely to be seen, and so we will dismiss them without further words. In appearance the remaining twelve readily arrange themselves into two groups, those with streaked breasts and those with plain breasts. The following simplified key is offered to assist in the identification of any sparrow seen in New York State. Unless otherwise stated, the birds nest in this State and are found throughout the summer months.

Name	Where found	Distinguishing marks
I. Sparrows with streaked breasts		
Vesper sparrow	Open fields	Grayish color, white outer tail feathers
Savanna sparrow	Open fields, reedy lake shores	Yellow lines on the head, short tail
Song sparrow	About bushes	Lines on head gray, larger spot in middle of breast
Fox sparrow	Thickets and weedy places in spring and fall	Reddish brown color, especially on rump and tail, large spots on breast
II. Sparrows with unstreaked breasts		
a. With the top of the head reddish brown:		
Chipping sparrow	Orchards, lawns, gardens	Black bill, black line through eye
Field sparrow	Bushy pastures	Pinkish bill, no line through eye
Tree sparrow	Hedgerows, weedy places during winter and early spring	Single spot in middle of breast
Swamp sparrow	Edges of marshes	Larger, resembles song sparrow with unstreaked breast
b. With black and white stripes on the head:		
White-throated sparrow	Woods and bushy places in spring and fall	White throat, yellow spot before eye, white stripes narrower
White-crowned sparrow	Same as white-throated, preferring more open country	Throat gray like breast and sides of head, white stripes broader
c. Top of head not noticeably different from back:		
House sparrow	Everywhere except deep woods	Black cravat of male, inconspicuous color and conspicuous habits of female
Grasshopper sparrow	Open fields	Seldom seen; identify by song, a weak, insect-like trill; shy and retiring.

If the main divisions of this key are borne in mind when observing a sparrow, there should be no difficulty in identifying it. The place where it is seen is often as important as the actual color of the plumage. In the following pages will be found a fuller discussion of the more common species.

THE ENGLISH SPARROW

Anna Botsford Comstock

The introduction of the English sparrow into America is one of the strongest arguments for nature study. Ignorance of principles that any child trained in nature study should know, in this instance alone costs the United States millions of dollars every year.

The English sparrow is the European house sparrow. It was thought to be an insect eater, but no one took pains to verify the surmise. About 1850, some persons with praiseworthy zeal but with lamentable folly introduced this sparrow into New York, and during the twenty years following other importations were made. In twenty years more, people discovered that they had taken great pains to establish in America one of the worst nuisances in all Europe. In addition to the direct damage done by the English sparrow, it is so quarrelsome that it has driven away many of our native beneficial birds. But since this bird is with us, if we can make it of any use let us hasten to do so. There is no bird that affords a more difficult exercise in describing bird colors than does the English sparrow; and furthermore, if the children of the land study the habits carefully, they may discover a more effective means of discouraging the presence and increase of this noisy, rascally bird neighbor.

It is amazing how few persons can distinguish the sexes of the English sparrow, although the two may be seen in every flock. In the male sparrow the top of the head is gray, with a patch of reddish brown on either side; the back is brown, streaked with black; the tail is brown; the wings are brown with two white bars and with a patch or stripe of red-brown; the sides of the throat are white; the middle of the throat and the upper breast are black; the lower breast and the under parts are grayish white. In the female sparrow the head is grayish brown; the back is brown, streaked with black and dirty yellow; the throat, breast, and under parts are grayish white and the bird has rather a faded appearance.

Although this sparrow is common, its coloring varies in vividness so much at different times of the year that I have known experienced bird observers to be misled by its appearance, especially by that of the female, and to think for some moments that it belonged to another species.

The chipping sparrow is much more slender and about an inch shorter than the English sparrow, and has the bright red-brown for a crown instead of for wing ornamentation. The song sparrow is only slightly smaller than the English sparrow, but its long tail gives it a much more slender appearance. The song sparrow has no bars on its wings and has a spotted breast with a larger dark spot at the middle, very different from the cravat of the English sparrow. The tail of the English sparrow is short and not notched at the end, and these peculiarities alone will distinguish it from the song sparrow and the chipping sparrow.

The size of the English sparrow is taken usually as one of the standards in noting the size of wild birds, and the pupils should be trained to tell its size accurately. This may be accomplished by comparing it with all other birds common to the region. The English sparrow measures 6.33 inches in length; the chipping sparrow, 5.37; the song sparrow, 6.30; the robin, 10.00; the bluebird, 7.01; the goldfinch, 5.10.

The English sparrow prefers the cultivated grains to the seeds of wild plants. It takes the seed after sowing, and also attacks the new grain in the sheaf. Wheat, oats, rye, barley, corn, sorghum, and rice are thus attacked. The bird also destroys buds and blossoms of fruit trees and occasionally injures the ripe fruit. It has the characteristic wide, strong beak of grain-eating and seed-eating birds.

When feeding, the English sparrow is noisy and quarrelsome; if there is no other species of bird for it to attack, the birds will fight among themselves — for this sparrow seems to have a " chip on the shoulder." When it sings, it gives voice to vexatious chirping; it squalls when frightened; cheeps plaintively when lonesome; and makes a great disturbance when fighting.

But in the matter of cunning we must admit that the English sparrow is the superior of many birds of more pleasing personality. Undoubtedly its achievements are due in large measure to its cleverness. It is very quick to take a hint. I know of several instances in which firing a shotgun into the midst of a flock of these birds drove them all from the premises, although none were killed. I have seen a mother sparrow employ the most skillful tactics in stealing earthworms from a mother robin who was trying to get them for her own family.

The nest of the English sparrow is built in a protected nook beneath eaves or other covering. Often it is placed in vines against a building, and occasionally it is built in trees. It is an untidy affair, made of coarse straws or grass and feathers without fashion or form. In these careless nests the whitish brown or gray flecked eggs are laid and the young reared. I do not know that the number of broods in a season has ever been recorded, but the sparrows begin to nest early in the spring and keep at it industriously until snow comes in the late fall.

In the summer, these sparrows scatter through the country for nesting and for greater food supply. In the winter they flock to cities and villages, living on the seeds in the refuse of the streets or in barnyards It is safe to say that the only welcome these little emigrants get in America is in the larger cities, where no other bird could possibly "make a living." They will not build their nests in boxes suspended by wire and they do not like a box having no resting place before the door; this latter preference may keep them from taking the quarters meant for bluebirds. If the opening to the nest is an inch in diameter, it will admit wrens and chickadees but will exclude the sparrows.

SUGGESTIONS FOR STUDY

What is the food of the English sparrow? Where is it found? How is the bird's beak adapted to get this food?

Describe the action of a flock of English sparrows feeding in the street or elsewhere.

Why does this bird stay with us in winter instead of going South?

Does it winter in country fields and woods, or about houses, or in villages?

Describe from observation how it treats our native birds and the result of this treatment.

Describe the nest of the English sparrow. Of what material is it made? How is it supported? How is it sheltered? Is it well built?

Describe the eggs. How many broods are raised each year by one pair of birds?

What kind of food do the parents give their nestlings?

What do you think of the ability of these sparrows? Are they stupid or clever? Give an account of things you have seen them do which indicate their stupidity or cleverness.

Try to find out under what circumstances the different notes of the English sparrow are used.

In what ways is this bird a nuisance? Is it of any benefit?

How can one build bird houses so that the English sparrow will not take possession of them?

How can we discourage this bird from living on our premises?

References to literature.— *Birds in Relation to Man*, Weed and Dearborn, p. 144; and the following publications of the United States Department of Agriculture: *English Sparrow in North America*, *Relation of Sparrows to Agriculture*, S. D. Judd; *The Food of Nestlings*, Yearbook, 1900.

Supplementary reading.— A Street Troubadour, in *Lives of the Hunted*, Ernest Thompson-Seton; *First Book of Birds*, Olive Thorne Miller, p. 81; A Blizzard and Three Sparrows That Lived in the House — from *True Bird Stories*, Olive Thorne Miller; The English Sparrow, in *Songs of Nature*, p. 233, a poem by Forsyth.

THE SONG SPARROW

Arthur A. Allen

Surely the song sparrow is one of nature's greatest successes. No adverse circumstances have been able to daunt this hardy adventurer. So versatile is he that he has adapted himself to all sorts of conditions and few are the places on this continent where some one of his kind cannot be found. No chill nor cloud nor rain can check his cheerful voice. Even darkness itself can only conceal the singer whose merry notes often break the midnight silence or add to the nocturnal chorus. Wherever there is a clump of bushes into which he can dive for protection from cat or hawk, we may hear his happy voice. It may be in our very barnyard or it may be in the thickets bordering the forest, for nearly everywhere he is one of our most abundant birds.

A hungry song sparrow in luck

Perhaps you do not know the song sparrow by this name, or cannot at present even recall his song. The boys sometimes call him " bush bird " or " long-tailed ground bird," but " song sparrow " is the preferred name. Surely you have seen the little brown bird sitting on fence rail or bush top, pouring forth his vivacious notes and diving into cover at your approach. Some birds fly up and away, depending for safety on flight; but not so the song sparrow. Always singing from an exposed perch, he depends for safety on cover, and flies into the nearest bush, pumping his tail up and down as he goes.

Unlike the vesper sparrow, the song sparrow is seldom found in the open field, and his nest, when placed on the ground, is always concealed by overhanging grass. Very often, however, the nest is placed in a low bush, so concealed by leaves and branches that one must actually get inside of the bush in order to find it.

All year long the song sparrows are with us in greater or less abundance. In winter the more northern birds move southward, but with a little search almost anywhere in New York State we can find the song sparrow all winter. At this time of the year, however, we seldom hear him singing and it is often necessary to tramp the brambles and brush heaps before we see him With the first few sunshiny days of spring he again comes out in full force, and it is not long before he is once more among our commonest birds.

The song sparrow is a streaked brown bird about the size of the house and vesper sparrows. A heavy spot in the middle of its streaked breast and one on each side of its throat will usually distinguish it from all the other sparrows. There are four common sparrows with streaked breasts in the eastern United States, of which the song sparrow is most abundant. A key for distinguishing them is given under the general article on sparrows.

Never far from the vicinity of bushes, the song sparrow is nevertheless one of the most common birds of village and farm. It may often be seen along the village streets or about dooryards, picking crumbs with the house sparrows. Much more abundant is it, however, along roadsides in the country, in bushy pastures, and in hedgerows.

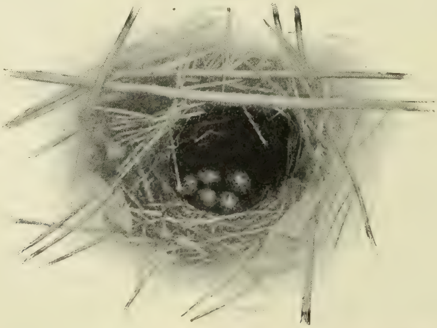
SUGGESTIONS FOR STUDY

The song of the song sparrow resembles that of the vesper sparrow, but is not so clear a whistle and begins with three instead of two notes of the same pitch. The song has been described as fitting the words, *Madge, Madge, Madge, put on your tea kettle-ettle-ettle.* See whether you can compose words of your own to fit the song.

The call note is the most characteristic and easily learned of any of the sparrows, being a rather distressed *chimp.*

The nest for the first brood is built on the ground during the latter part of April or the first of May. Later, nests are very often built in bushes. What reason can you suggest for this difference?

The nest is composed of rootlets, straws, and grasses, and is generally lined with long hairs. The eggs are blue and vary considerably in the amount of brown spots and blotches.



Nest and eggs of a song sparrow. Much of the overhanging material has been removed in order to show the eggs

THE WHITE-THROATED SPARROW

Arthur A. Allen

A white-throated sparrow receiving hospitality

Sweetest songster among the sparrows, the whitethroat returns to us from its winter home in the Southern States about the middle of April; and from that time until the middle of May, hedgerows, thickets, and wood borders resound with its plaintive, sympathetic whistle. *Poor-Sam-Pea-body — pea-body — pea-body*, he calls. The last notes are so plaintive and tremulous that we wonder what could have happened to poor old Sam, that this bird should have taken it so much to heart. The less accomplished singers often so shorten the last three notes that it is rather difficult to interpret them as *pea-body*, but *poor Sam* is always unmistakable. The first note is usually low, the second a full octave higher; but even this is sometimes varied, and the first note is given extremely high. The notes are always clear, pure whistles, however, and with a little practice one can imitate them exactly. I have many times entered a wood where whitethroats were busy scratching among the leaves, for the time being forgetful of poor Sam's woes, and with a few whistled imitations of their song have brought dozens of birds up to the lower branches of the trees to answer me and to vie with me as to which of us could pitch his whistle the highest.

In size the white-throated sparrow is about the same as the house (English) sparrow. The general color of the upper parts is streaked brown, and of the under parts unstreaked gray. The distinctive features are the black and white stripes on the head, the white throat-patch, and the yellow spot before the eye. Immature birds have the black and white replaced by brown and gray. Male and female whitethroats are similar; but most birds in the fall, and all the immature birds, have the black and white head-stripes obscured with brown and gray, and the white throat-patch less sharply defined. It takes them at least two years to acquire their full plumage; and the immature birds are not so easily identified in the field as are the adults. In all plumages there is a yellow spot before the eye; but one needs to be very close before this is visible, especially with the immature birds in which it is duller. The immature birds arrive later in the spring than do the adults, being commonest after the first of May.

In its nesting habits the whitethroat resembles the song sparrow, building on the ground or in low bushes. It is more of a woodland bird, however, and makes use of strips of bark and bits of moss in the construction of its nest more than does any song sparrow. The eggs, too, are similar, being bluish white, speckled, or blotched with rufous brown.

The whitethroat is a migratory bird in most parts of New York State, nesting regularly only in the Adirondack region or where the high hills in other parts of the State simulate Canadian conditions. In the Adirondacks and all through the spruce forests of Canada, however, its voice is heard throughout the summer and is one of the characteristic bird sounds. In most parts of the State the whitethroat leaves by the middle of May, not to return until the middle of September. Then once more the thickets resound with its voice, for it is one of the few birds that sing their full song in the fall of the year. About the first of November it again leaves for its winter home in the South. While with us the whitethroats are extremely sociable, usually being found in scattered flocks, sometimes in large numbers. In migrating they fly at night, and one familiar with their *chink* or *tsip* call-notes can frequently hear the birds flying overhead during the migrating period.

QUOTATION

"His song consists of 'two long clear notes followed by two or three triplets.' It has been variously translated as 'Old-Sam-Peabody-Peabody-Peabody'; 'Swe-e-et Can-a-da, Can-a-da, Can-a-da'; 'All day, whit-tle-ing, whit-tle-ing, whit-tle-ing'; and William Hamilton Gibson tells of a perplexed husbandman, Peverly by name, who, hesitating at his choice of crops, heard him advise, 'Sow wheat, Pev-er-ly, Pev-er-ly, Pev-er-ly.'"—From *Birds in Literature*, by Abby P. Churchill.

THE CHIPPING SPARROW

(Chippy, hair bird)

ARTHUR A. ALLEN

With the exception of the robin, perhaps no one of our native birds is more sociably inclined than the chipping sparrow. Hopping about our lawns and gardens, he soon becomes accustomed to the passing of persons, and often becomes so tame that one can approach within two or three feet without frightening him. In fact, it is not a difficult task to tame chipping sparrows so that they will feed from one's hand, and they very readily respond to a little kindness, and come regularly to be fed if seeds or bread crumbs are habitually scattered in the same place. The accompanying photograph is that of a bird which comes regularly with its mate to be fed at the writer's back door.

In size the chipping sparrow is smaller than the house (English) sparrow. In color it is streaked brown above, and gray below. The distinctive features are the reddish brown cap, black bill, and black line through the eye. It is common about lawns and gardens.

A chipping sparrow partaking of the meal provided

The chipping sparrow arrives in central New York in the first week of April, and leaves at the end of October, spending the winter months in scattered flocks in the Southern States. When the birds first arrive in the spring they are less friendly than they become later, and spend their time in the tree tops. As soon as the grass gets green, however, and the dandelions are in seed, they drop to the lawns where they find a bountiful repast on the newly formed seeds.

The first nests of the chipping sparrows are commenced about the beginning of May, and are often placed very near the house, in the vines on the porch, in the lilac bushes, or near the tip of a low branch on the apple or the evergreen tree. The nest is a beautiful little structure composed largely of horsehair, with a few grasses or rootlets on the outside. For this reason the chippy is sometimes called " hair bird." The eggs, numbering four or five, are a delicate blue or greenish blue, with a circlet of brown or black markings about the larger end.

The chipping sparrow is one of the birds very frequently imposed on by the parasitic cowbird.

THE VESPER SPARROW

Arthur A. Allen

Where is the boy who has not found a "ground bird's" nest? Where the boy who feels no thrill when the bird flutters from beneath his feet, or the one who does not know the excitement of the search and the joy of finding the four speckled eggs tucked away in a neat little nest? Most boys recognize several kinds of these "ground birds," as they call them. There are those that nest in bushes or hedges, those that nest beneath the bushes, those that nest in tussocks nicely sheltered by the overhanging grass, and still others that nest far out in the open field away from bush or tree of any kind. There is no roof over this last "ground bird's" nest; and when the bird leaves, the eggs are exposed to the sky. They are bluish or pinkish gray, more or less covered with spots and blotches of brown, and usually with a few scratches of black at the larger end.

When the bird flutters from the nest with outspread wings and tail, we see that its outer tail feathers are white and we know it is a vesper sparrow. We should not use the confusing name of "ground bird" for all the small brownish birds that nest in the bushes and on the ground. Instead, we are going to call them sparrows and learn to distinguish one kind from another, not only by the color but by the song and even by the nest and eggs.

The vesper sparrow is one of the commonest of the sparrows. It comes to us in the spring, in the early part of April, and delays its southward migration until the last of October or the first of November. Indeed, some years when the weather is exceptionally mild, it may stay with us all winter. With the advance of spring, while the grass and clover are still short in the meadow, the parental cares of these birds begin. Unlike the song sparrow, they do not choose a place where the thick grass will roof over their nest, but select a slight depression in the shelter of a hummock. The top of the nest is even with the surface of the ground, so that one may step on it without breaking the eggs. The eggs vary considerably, but can always be distinguished from those of the other sparrows by the stain-like spots and by the characteristic black scratches that are usually present at the larger end.

The vesper sparrow is one of the birds that run along ahead of you in the road. Often it seems to wait for you to catch up, and then skips along again, always keeping at a safe distance. If you increase your steps, it spreads its wings, but, after flying a short distance, drops down and again awaits your approach. When the bird flies, we most easily recognize it as a vesper sparrow, for then it spreads its tail and we see that the two outer feathers are white. Very often we see the bird sitting on a wire or a rail fence, for it always chooses some such exposed perch from which to pour forth its clear, sweet song. Especially toward evening we hear the melody, and then we realize how truly is this bird the vesper sparrow.

The vesper sparrow is a typical bird of the open country. It does not appear until the forests have been cleared away. Then it becomes one of the commonest birds of the open fields, the garden, and the roadside.

The surest way to recognize the vesper sparrow is to see the white outer tail feathers. The meadow lark also displays white patches in its tail, but it is a much larger bird, being the size of a robin. The junco also has the white outer tail feathers, but it is an even slaty black above. The vesper sparrow is grayish brown and streaked. When you cannot see the white tail feathers, the vesper sparrow very closely resembles the song sparrow, both being of about the same size and having streaked breasts. The vesper sparrow, however, is much grayer, and lacks the large spot in the middle of the breast which is characteristic of the song sparrow.

Nest and eggs of the vesper sparrow

SUGGESTIONS FOR STUDY

Try to learn the song of the vesper sparrow. It is a much clearer and purer whistle than that of the song sparrow and begins with two short notes of the same pitch instead of three.

What would you say of the importance of this bird to the farmer? Its food varies considerably with the seasons. During the winter in the South it consists principally of seeds of ragweed, pigeon grass, crab grass, and the like. In the spring, many weevils and click beetles are eaten, and later an abundance of crickets and grasshoppers.

THE TREE SPARROW

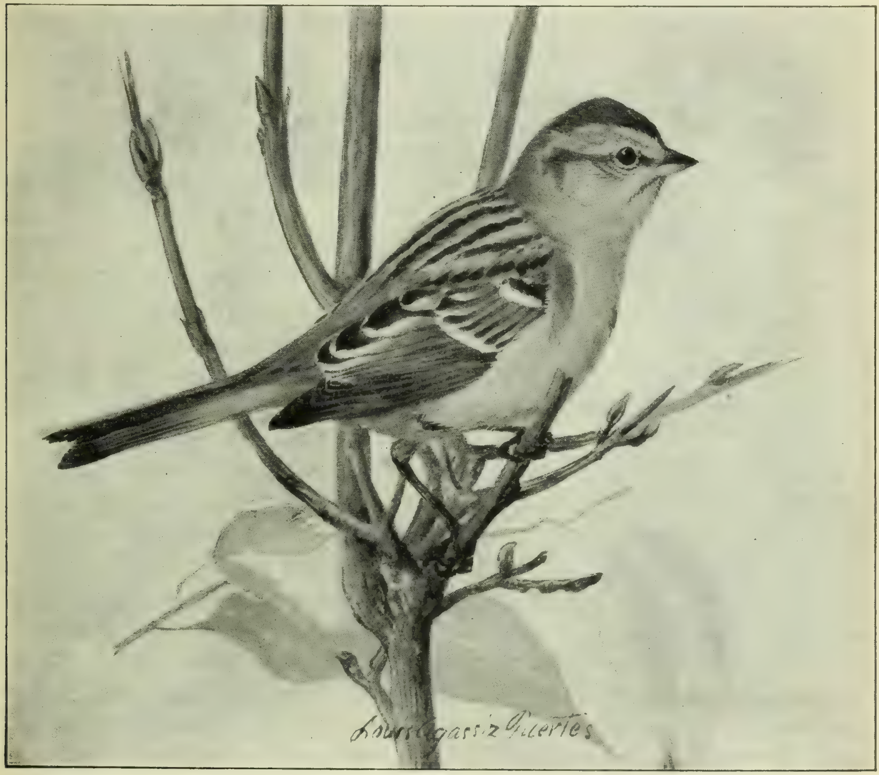
ARTHUR A. ALLEN

It was cold. Oh, how cold it was! Our feet were cold, our ears were cold, our very bones were cold. For many hours we had tramped through the drifted roads until it seemed that we should never get home. Several miles still lay before us, not a bird had we seen, not an animal, not even a track in the snow to interest us, except, perhaps, those of the dogs and horses that knew no better than to keep in the road. Suddenly the same thought struck us both. We would leave the road and cross the fields, where there is something to look for, something to find.

And what interesting things one can find in the snow-covered fields when one knows where to look and what to look for! A rabbit has passed the night under a bush; a squirrel has burrowed down through the snow for a nut hidden several months before; a mouse has left the shelter of the fence to hunt across the open field; a tumbleweed has blown across some time before — all have disappeared and yet their story is told as plainly as though it were written in a book.

What is that we see? We have come to a field overgrown with ragweed and pigeon grass. The tops still project above the snow. And there on the snow is written the story of a bird's banquet. A lace work of tracks connects one weed with another. Seeds and other particles are scattered over the snow. But the birds themselves are gone. No, there they are ahead of us! The old hedgerow seems to have come to life. Such a twittering! Every bush and every weed is alive with birds and every bird has something to say to his neighbor. Such cheer we could scarcely have imagined. Here on a cold January day these birds seem as bright and happy as though it were midsummer. In a moment, cold feet and cold ears are forgotten. What could they be, these little creatures so happy and sociable on such a raw day? We look closely and find that they resemble the chipping sparrows, which are so abundant about our houses during the summer. But the chipping sparrows, we know, have long since departed for the South. What then, can they be? Suddenly one of the birds turns and faces us and we see that its gray breast, instead of being entirely unstreaked and unspotted as it is in the chippy, bears in the center a single dark spot. There is but one bird that has such a spot; therefore we know that these must be tree sparrows. And what sociable little birds they are, simply bubbling over with happiness. Indeed, their happiness is contagious; and we find that many other birds like to associate with them. If they are not right amongst them, they like to be at least within hearing distance. Chickadees, nuthatches, downy woodpeckers, and brown creepers feed on the trees near by; while juncos, if they dare still to remain with us, feed right among them and join in the conversation with their merry twitter. Who minds the cold with such company? Our woes are forgotten and we are home before we know it.

The tree sparrows spend their summers in the Far North, in Labrador and around Hudson's Bay. There they build their nests, on or near the ground, and raise their families. In the fall they leave for the South, arriving in New York State in the latter part of September or the first of October. A great many continue their way farther south, but many remain with us all winter. In April they begin again to think of their family cares and leave us for the North. It is at this time that they begin to sing a song that is one of the sweetest of the spring. Rather soft and low it is, but quite canary-like in its character, at times seeming to come from a great distance even though the singer be close by.



Tree sparrow

Over fifty per cent of the tree sparrows' food consists of the seeds of obnoxious weeds, and great credit is due the birds for the large number of weeds thus destroyed.

SUGGESTIONS FOR STUDY

The food of the tree sparrow being almost entirely the seeds of weeds and grasses, one should look for these birds in places where weeds project above the snow; weedy slopes, the edges of woods and marshes, along fences and hedgerows, all these are likely places.

The tree sparrow is a brownish bird with gray, unstreaked under parts, a reddish brown cap, and two white wing-bars. Note particularly a single dark spot in the middle of the breast.

Note the heavy conical (sparrow) bill for crushing seeds.

Note the tracks in the snow. Does the tree sparrow walk or hop?

Listen to the call note. How does it differ from that of the junco?

Does the tree sparrow sing in January?

THE CANARY

ARTHUR A. ALLEN

Probably no bird is better known the world over than the canary. Native to Madeira, the Azores, and the Canary Islands, it was first introduced into Europe as a cage bird early in the sixteenth century, and has since been carried to all parts of the civilized world. The wild birds are about the size and shape of a sparrow; in color, olive green above, greenish yellow mottled with dark brown below. All the brightly colored canaries, together with those of varied shape and stature that are now seen in captivity, are the result of careful breeding from chance variations that have appeared. The so-called " hot canary," which has a brilliant flame-yellow plumage and which commands a high price, is produced by carefully mixing cayenne pepper with the food, especially when the bird is young. The raising of canaries is an important industry in certain parts of Germany and the British Islands.

Canaries breed freely in captivity, sometimes raising four or five broods a year. In the wild state, the nest is placed in a thick shrub or a small tree, often an evergreen, eight or ten feet from the ground. The four or five eggs are bluish or greenish, spotted with reddish brown. When not nesting wild canaries fly about in small flocks, frequenting wooded districts — especially pine woods — vineyards, and gardens; and in their habits and undulating flight they resemble our goldfinches.

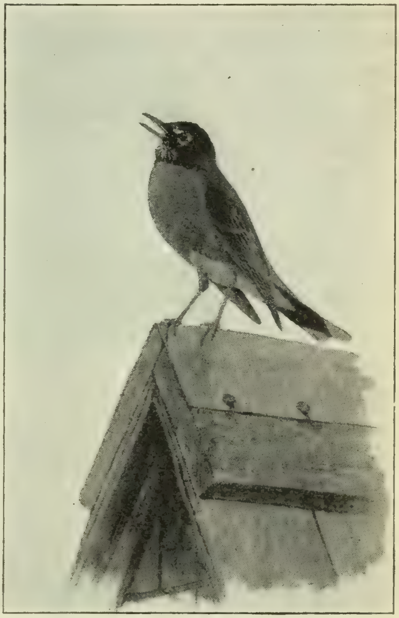
In captivity the birds require a clean cage, good seed, some green food, lime, and plenty of water for drinking and bathing. Many books have been written on canaries and their care, of which the following might be mentioned: *Canaries and Cage Birds*, by W. A. Blackston, and *The Canary Book*, by R. L. Wallace.

The name "wild canary" in this country is often incorrectly given to the yellow warbler and to the goldfinch.

THE ROBIN

Arthur A. Allen

Icy drifts still fill the shaded fence rows and the chill north wind still speaks of snow and winter. Three times the ice has stilled the noisy frogs, three times the whitened marsh has shown brown by noon, and now by the laws of the sages spring should be here. A peeper chirps in a neighboring pond; a chickadee gives his *phoebe* note; a nuthatch rolls his springtime call; and there in the orchard on a topmost branch appears the robin. "Good luck," they say, "to see him first on highest branch." Good luck to see him anywhere! Never so rich am I as after seeing the first robin; then home with the glad tidings! "The robin has come and spring is here!" Watch him as he flies to the sun-warmed spot where perchance an early worm may be found. How brilliant is his chestnut breast, how green the grass, how soft the air! We overlook the stubborn drifts, we forget the icy crystals fringing yonder pond. All is changed, and the robin has changed it.



Robin

Through the long winter he has been with flocks of his fellows in the sunny southland, feeding on berries of mistletoe and holly, and now he is back once more with an appetite for grubs and worms. Occasionally he passes the winter in our chill northland, if he can find a sheltered spot with berries of cedar, grape, or mountain ash; but usually he leaves us in October for the land of plenty. With the first signs of spring, however, back he flies, the harbinger of all the wealth to come. Were he less common, he would no doubt be thought by all a kingly bird, the pride of the whole thrush family. Let him hide in distant forests and reveal himself to a lucky few only, and there would be no bird that could excel his beauty, dignity, or song. Unfortunately for his reputation, but happily for mankind, he is one of our most abundant birds and is most content about our dooryards. He and Chanticleer announce the day. *Cheer up, cheer up, cheerily, cheerily, cheerily,* he sings; and one wakes with a smile. How much easier to start the day right when this is our morning summons!

The male robins come first in the spring and await the arrival of their mates. Frequently they do not sing for many days, or even weeks, after arriving, but when the females come in late March or early April they commence their morning and evening choruses. Unlike many brightly colored birds, the males and the females are frequently alike in coloration, the duller colors of some being due more to youth than to sex.

After mating takes place, both birds join in building the nest, which is placed in a crotch on a horizontal limb or on some projecting ledge about our dwellings. Frequently the site is retained year after year. The nest is a rather bulky structure, but a marvel of symmetry in the plasterer's art. An outer layer of straw, rags, and paper is neatly hollowed and filled with wet mud. Bill, feet, and breast are used until a perfect bowl is formed. This is lined with finer grasses until the home is complete. Three to five blue eggs are laid, which both birds take turns in incubating.

Like the young of all our song birds, the robins when first hatched are naked and blind and it is two weeks before they are fully feathered and able to leave the nest. At this time they differ somewhat in color from their parents, for their breasts are much paler and are covered with large, round, dark spots. In this plumage they are more like other thrushes and show their family characteristics much more plainly than when fully grown.

After the young are able to care for themselves, the parent birds usually start a second brood. It is now that they begin to gain a rather unfortunate reputation because of their fondness for fruit. It has been found, however, that by planting mulberries or some of the native fruits it is often possible to attract the robins from cultivated cherries and berries, and thus protect the fruit in a way that is more satisfactory than by killing the birds. It is doubtless true, however, that in some fruit districts where the natural food supply has been replaced by the much more dependable cultivated fruits, the robins have increased unduly and now do considerable damage; but killing should never be resorted to until competent scientific investigation has been made.

THE BLUEBIRD

Arthur A. Allen

Bluebird

The first robin has been seen in the orchard, scolding at the drifts that cling so long to the fence rows. An early peeper chirps from the pond by the roadside, and the whole landscape steams beneath the bright March sun. A gentle breeze brings us news from the southland and gives us the first fresh odor of spring. Then out of the clear heavens comes the call of the bluebird, gentle and soft and full of gladness, breathing of life and happiness and joy to come. What a wealth of feeling comes with those first mellow notes, what friendliness, what good fellowship toward all nature. The robin scolds at the surly snowdrifts, he sulks whenever the weather turns cold; but not so the bluebird. The March winds with their snows and ice hold no terrors for him, his merry call is never without optimism.

The bluebird is so well known that it hardly needs a description. In size it is between the sparrow and the robin. The male is much more brilliant than the female, bright blue above and reddish brown below, except for the belly which is white. The bird does not appear blue, however, unless the light falls just right, and undoubtedly because of this many are passed without being recognized. Its shape, though, is unmistakable to the experienced eye, appearing as if somewhat round-shouldered. The male bird, moreover, has the habit of fluttering one wing when alighting. These characteristics, together with its cheery call, should always identify it.

The bluebird sometimes arrives in Ithaca as early as the last week of February, but usually it is the first week of March that brings him. We always begin to listen for him on the day following the first robin, and many, many times he has come just as we have expected him. Occasionally the robin gets here a week or more before the bluebird. That is usually a sign of more cold weather, for the bluebird is a better weather prophet than the robin, and is not so often overtaken by the late snows. Then come the song sparrow, the wild goose, the red-winged and the crow blackbird; and it is the middle of March.

Now is the time to have the nesting box ready to coax the bluebird from orchard or roadside to a more intimate place beneath the window or on a post in the yard. The bluebird delights in a nesting box, almost preferring it to a hollow limb in the orchard; and now that the modern orchard has so few dead limbs and knot holes, we should feel it our duty to build the nesting boxes. Almost any sort of box may be selected by a pair of bluebirds for their home, but the one that looks most like the old hollow limb in the orchard will prove most attractive. The entrance hole should be made on one side near the top, and should be about an inch and a half in diameter. No nesting material should be placed in the box, unless perhaps a little sawdust in order to make it seem more like a real cavity. When the bluebirds have once found the box they may return to it year after year.

The bluebird builds a well-formed nest of rootlets and grasses, and three to five pale blue eggs are laid in it. Both birds take turns sitting on the eggs, which hatch in less than two weeks. The young remain in the nest about two weeks longer; and for some time after they have left the nest they are fed in the trees by their parents. Before they are able to shift for themselves, however, the parent birds begin a second nest. Occasionally they pull out the first nest and build the second in the same box, but oftener they move to another site; so that it is always well to provide more than one box.

The young bluebirds when they leave the nest do not resemble either of their parents, for their backs are marked with whitish and their breasts have dark spots. In the latter respect they show their relationship to the true thrushes, all of which in some plumage have spotted breasts.

In the late summer and fall the bluebirds gather in scattered flocks, frequently associating with chipping sparrows, and are found all through the open farming country. Their call at this season, *tur-ree*, *tur-ree*, while quite as friendly as the note of spring, has just a tinge of sadness, and seems as much a part of the fall months as are the calls of the katydids or the rustle of the dead leaves.

WILD DUCKS

ARTHUR A. ALLEN

The cold north wind sweeps across the marsh, the hoar frost whitens the brown cat-tails, the ice crystals reach out from the edges of the ponds, and the wild duck knows that it is time to seek the warmer waters of the southland. Flock after flock sweeps across the heavens, now high over hilltop and city, now low over lake and river, now circling over marsh and pond, dropping with a splash among their fellows or calling to them to be up and away. There are those "winged bullets," the teals — bantams among ducks — that whiz past us like shots from a gun; flocks of mallards and pintails with more labored flight; widgeons, shovelers, redheads, whistlers, bluebills, canvasbacks, and scoters that come to us as the season advances; and that most beautiful of all, the wood duck with its brilliant markings.

Wild ducks accepting a goodly meal

A hundred and twenty-five different kinds of ducks are known to the world, although we in the United States know but forty-two. They are all alike in having the soft flat bill and the webbed feet; but they are very different in size and color. Some are white; others are black; and many kinds have various shades of red, blue, and green in their plumage.

To learn to know all of the ducks is a very difficult task, because most of them are wary and will not permit a close approach. This is because they are very often pursued by hunters. In some places where they are protected by the laws or by wise men who own lakes or ponds and prevent shooting, they become very tame and will even eat out of one's hand. As soon as they leave these sheltered spots, however, they become as wild as ever.

Most of the ducks that visit us in the spring and fall build their nests in the marshes of the Far North; but many of them would stay with us all summer, if they were allowed undisturbed resting places. A few ducks build high up in holes in trees, but most kinds make their nests on the ground near marshes by pulling the downy feathers from their breasts. When they leave their nests, they always cover the eggs with feathers to make them less conspicuous.

The young ducks when hatched are covered with soft downy feathers, and are able to swim. The families are usually large, some ducks laying as many as twenty eggs. As soon as they are sufficiently grown they join other families, until sometimes, by the time they reach their winter homes in the South, enormous flocks are formed. These flocks frequently number into the thousands, but are much smaller now than they were twenty years ago. In time, unless they are properly protected by laws, they will all be killed, and we shall not have any of the wild ducks that make our lakes and rivers so interesting.

WILD GEESE

ARTHUR A. ALLEN

Birds may come and birds may go, and most persons are none the wiser; but when the wild geese come honking from the South, even the least observant are made aware of their arrival and are compelled to absorb at least one object lesson in the migration of birds. It is the first week in March before they are heard. The robin and the bluebird are already calling in the orchard, and the song sparrow sings by the wayside. They are as likely as not to announce their arrival through a flurry of snow or a dense fog, for they seem to prefer dark days on which to migrate and later in the season they travel largely by night. Some days the air seems filled with flocks of geese making for their more northern breeding grounds, and the sound of one flock scarcely dies away in the north before another has appeared in the south. The flocks are much more regular in their V-shaped form than are the flocks of ducks which often accompany them. Their wing strokes are more leisurely.

In size the wild goose, or Canada goose as it is sometimes called, is larger than a duck and smaller than a swan. The general color is grayish brown, the under parts lighter, and the head and neck black. The white throat and the crescent on the side of the black head will distinguish it from all other waterfowls of New York State. The rump is white and the tail black.

In former years wild geese were much more abundant than they are now, and often nested as far south as New York State; but at present their nesting range is restricted to the most northern of our Western States, and northward to the limit of trees. The nest, built of sticks and grasses, is placed on the ground, often on an island; and like the nests of ducks it is lined with down from the breast of the old bird. The eggs, four to seven in number, are whitish, and are not very different from those of the domestic goose. Several other species of wild geese have been recorded in New York State, but this is the only one of general occurrence.

Wild geese are usually exceptionally wary birds, and while feeding they post sentinels, which makes them difficult to approach. They are vegetable eaters and search for their food largely in upland fields, but they also dip in shallow water for water plants. Their wariness is largely a result of their being hunted, and on ponds where they are habitually fed and protected they become very tame.

The domestic goose has been bred from the European graylag goose, from which it now differs only in its larger size and somewhat paler coloration. The graylag goose is grayish brown, with the lower breast and the belly white. It formerly nested over a large part of northern Europe, but it is now restricted to the wilder parts of the continent. Several breeds have developed in captivity, one of which is pure white. The white geese with the large red knobs on their bills are domesticated Chinese geese.

In former years the business of goose-raising was very extensive in some parts of England, flocks of a thousand tended by a gooseherd being not uncommon. They were taken to pasture and driven to water like cattle, were plucked of their down five times a year, and in the autumn were driven to London or some other large market at the rate of about a mile an hour, or ten miles a day.

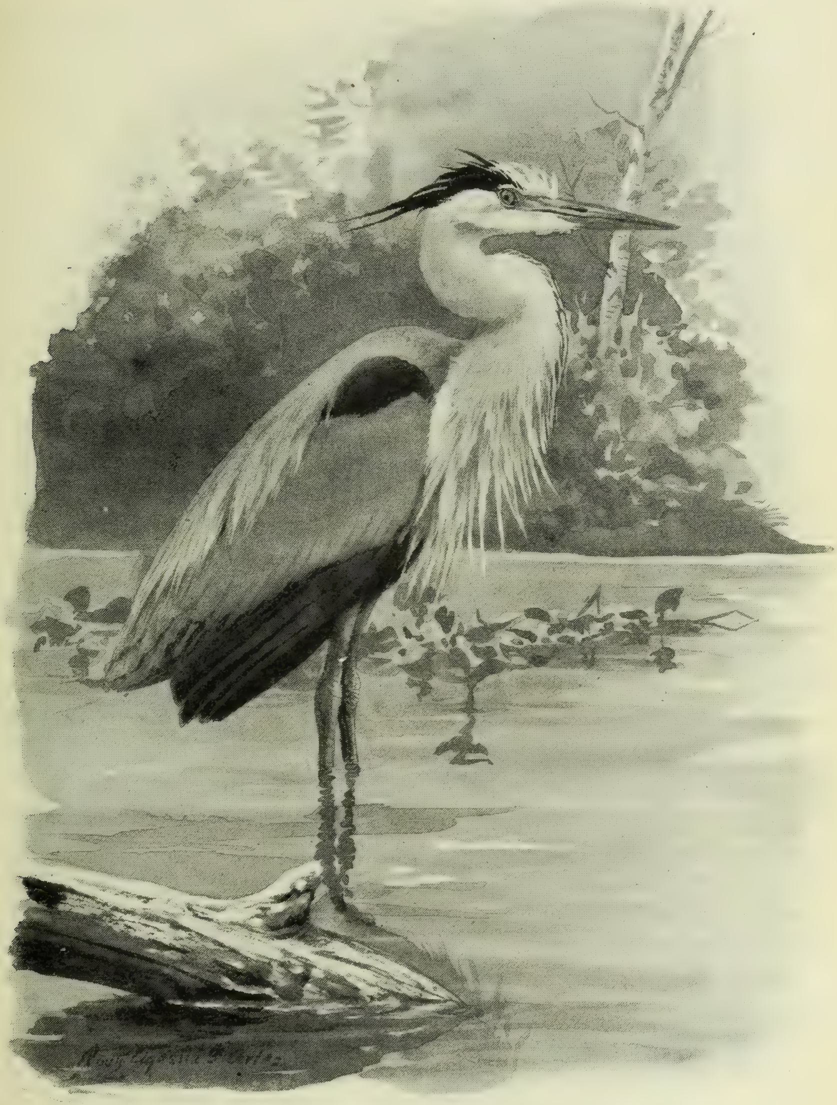
THE HERON

ARTHUR A. ALLEN

Silent and stately the solitary heron stalks along the shore, now curving his graceful neck and darting his spear-like bill at some unfortunate fish or frog, again standing humped up like a piece of driftwood or an upturned root awaiting his quarry. He seems asleep, but watch him if a school of minnows comes his way. Not a feather moves, scarcely a turn of the head before with lightning swiftness the long curved neck straightens, and the prey is transfixed. He seems ever silent, and many persons who have watched him will say he has no voice. True it is, he has no music in his voice, and seldom expresses himself with what he has; but come upon him unawares so as to startle him, or watch him when another heron trespasses on his hunting ground, and you will hear such a tremendous squawk that you will never again think the heron voiceless.

A young heron

With the disappearance of ice from the lakes and streams and the first appearance of schools of small fish in the shallows, when the leopard frogs begin to sing in chorus, and when the kingfisher once more rattles down the stream, about the last of March or the first of April, the great blue heron comes back to us from the South. Most birds prefer to travel and to feed in flocks, and scatter in order to find seclusion for the nesting season, but not so the heron. He comes alone; he hunts alone; but when the nesting season arrives, he seeks the company of his fellows. All the herons of a county assemble in one swamp and establish a heronry, as it is called. There they build their nests in the tops of tall trees, sometimes six or seven in one tree. During the day they scatter to all points of the compass in order to hunt, but each night brings them together again.



Great blue heron

The great blue heron is four feet in height and about six feet in expanse of wing. The general color is slaty gray above; head and neck, paler;

black and white below; and top of head, black, the feathers lengthened to form a crest. It is the largest of the herons. All herons have long legs, long necks, and long, sharply pointed, spear-like bills.

The nests of the great blue herons are crude affairs of sticks, as are those of all herons, and the three or four eggs are pale blue without spots. The young herons before their feathers appear are rather grotesque creatures apparently all head and neck, rather sparsely covered with scraggly down.

There are about one hundred species of herons found in all parts of the world, of which eighteen occur in North America. They are most abundant in tropical countries and only three species are found regularly in New York State. Of these the little green heron is the smallest and the most widespread, being found along every alder-fringed stream or pond in the State. It is about the size of a crow; bluish gray above and chestnut below, the entire neck being of the latter color, while the crested feathers at the top of the head and the wings are green. It is variously known as "shitepoke" or "fly-up-the-creek" by the boys, most of whom are familiar with it as it springs into the air ahead of them as they wade up the creek, utters a startled *skeow*, and flies off around the bend. It is a much more solitary bird in its nesting than the great blue heron, usually nesting alone, although occasionally as many as a dozen pairs assemble in the same corner of a swamp. The nests are placed in the tops of alders or low willows and are about the size of those of a crow, but are much more poorly built of rough sticks and are without lining. The eggs are often visible from below.

The third species is the black-crowned night heron, of more local distribution than the last. It is larger than a crow; ashy gray above and white below, the top of the head and the upper part of the back being glossy black. It is largely nocturnal in its habits and is more often heard than seen, for it flies about after dusk, uttering occasionally a rather hoarse *quawk*.

Herons, especially the great blue, are frequently but incorrectly called cranes, which in a superficial way they resemble. As cranes are now extremely unusual in New York State, any that are reported are probably herons. One easy method of distinguishing herons and cranes is their method of flight; the heron folds back its long neck so as to bring its head back on its shoulders, while the crane carries its neck outstretched. Both herons and cranes hold their long legs straight out behind.

Editors' Note.— The birds specifically named for study this year are presented in the foregoing pages. In addition to these birds, teachers are requested to have the boys and girls become familiar with two winter birds. Following are given a few from which two may be selected for special study.

THE SNOWFLAKE

ARTHUR A. ALLEN

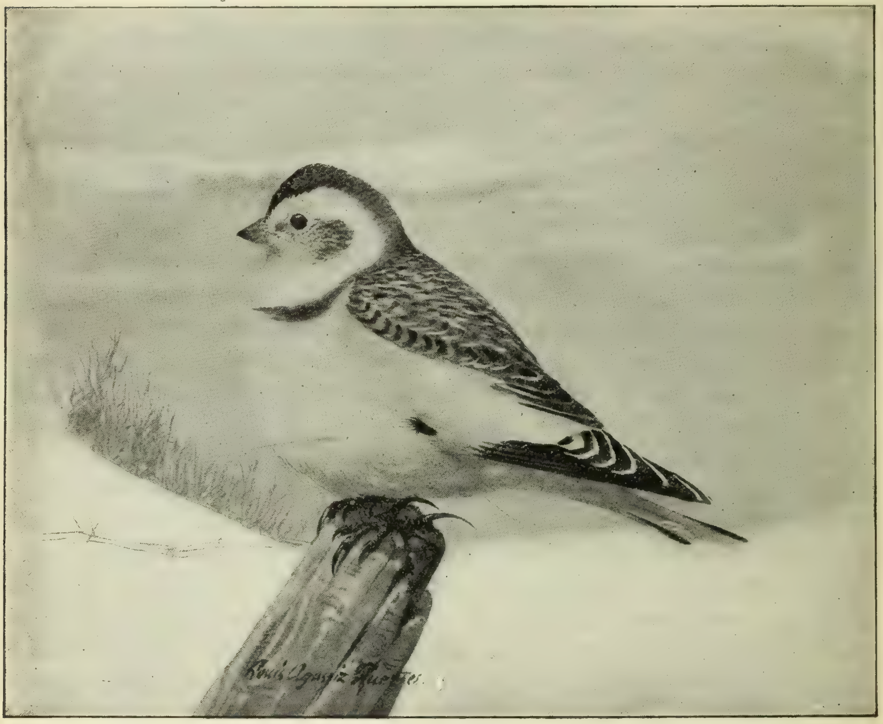
Again it is February. The chill north wind, sweeping across the fields, picks up the sharp snow crystals and drives them into our faces. The crust snaps and creaks under our feet as we pass from one sheltered wood to another.

Not a very good day for birds, we think, as we start across a large open field. Even the tree sparrows seek shelter on such a day. Never is there a winter's day so cold and raw, nor a summer's day so hot and sultry, but there are birds to be found somewhere. As we start across the field, we hear a sound that makes us stop and strain our ears. Away to the north of us, somewhere in the atmosphere, we hear it again — a short, mellow, rolling whistle. It is answered by another and another until we know that there is a whole flock of birds, and they are coming toward us. Yet, try as we may, we cannot see them. Suddenly they are right above us, fully five hundred of them, and we no longer wonder that we had not seen them before. Apparently almost entirely white, they pass over us like a flurry of snow and we can scarcely believe that they are birds. See with what military precision they wheel first in one direction and then another, and at last with a final sweep settle down on the weeds of a neighboring field. At first they are uneasy, and many times they rise up as with a single thought and, after circling around, settle back again.

At last we are able to get a good look at them and we find that they are not so white as we had at first supposed. In fact, their wings except for a large white patch, and the middle of their tails, are black. Their backs, too, if it were not for a suffusion of brown and gray, would be black; and their heads and breasts, which we had supposed were pure white, are somewhat rusty tinged. Nevertheless they are much whiter than any of our other small birds and we know that they are snowflakes. How happy and cheerful they are on this blustering day! Their gaiety seems almost out of place as they stop their feeding long enough to chase one another over the icy crust or to give that merry call note which first told us of their arrival.

The snowflakes are rather erratic, being much more abundant in some winters than in others, so that in their winter migrations we do not always see them. Along the seashore they are generally more abundant than inland; but scarcely a year passes without some of them drifting over the interior and visiting our grassy fields wherever the wind uncovers the weeds. In New York State they are truly snowbirds, for they appear with the first snows of October or November and disappear with the thaws of March or April. It is, however, during January or February, a time when other birds are least abundant, that we are most likely to see them.

The summer home of the snowflakes is in the Far North, where the summers are short and cool and the winters are long and exceedingly cold. There they build their nests on the ground and line them with feathers. Then, when their little ones can leave their cozy homes and follow, they gather together in large flocks and start toward the South. But, unlike many birds, they are fond of the winter and leave their northern home only as their food is covered by the snow; and they travel south only far enough to find food. It is for this reason that we see more of them during January and February, when the snows in the North are exceedingly deep.



Snowflake

SUGGESTIONS FOR STUDY

Look for a bird about the size of a sparrow, very white, traveling in a flock.

The snowflake is found in open, weedy fields, often near the house, but preferably in the more open country.

Note the shape of the bird, with its large head and shoulders and heavy bill. Is it a sparrow?

Look for the snowflake's tracks in the snow. Does it hop, as do the junco and the tree sparrow, or does it run?

Watch the flock as it rises from the ground or as it is about to alight, and see in what unison the birds turn or circle.

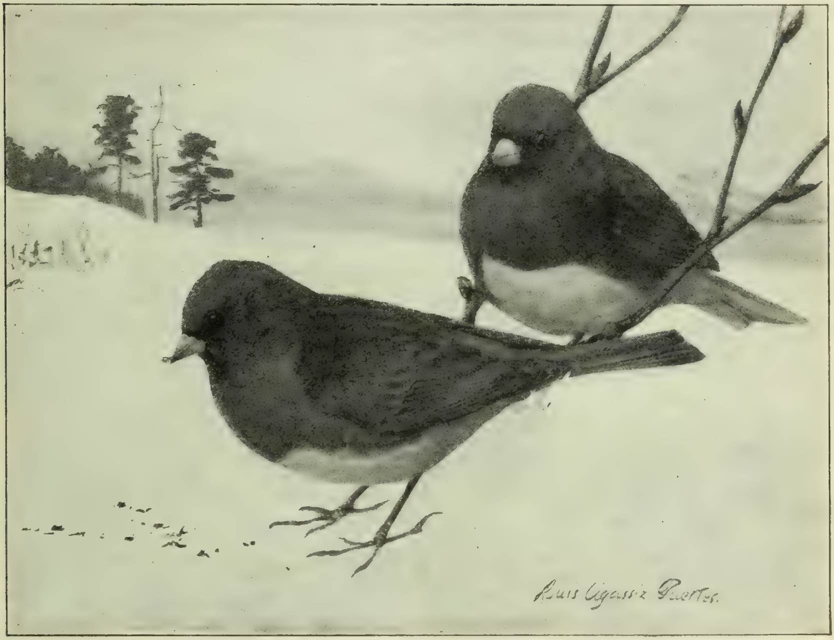
Do they ever alight on trees? on fences?

What other birds do not alight in trees?

THE JUNCO

ARTHUR A. ALLEN

Bright light was streaming from all our clubroom windows. Within everything was cheerful, but without all was dark and cold, for it was already late in October. Suddenly we heard a tapping at the window, and looking up we saw a flutter of wings against the glass. We hastened to open the window, and in flew a little bird.



Junco

Just the color of the night he was, without a streak or a spot except for a little apron of white extending from his breast backward. Even his throat and breast were slaty black. When he flew from the window to the bookcase, however, he showed us that his outer tail feathers were as white as his breast. It was a junco. Some persons call him snowbird, but there is another bird which has that name; therefore we shall call this one a junco.

Why had the little junco come to our window, where had he been, and where was he going? I wish he could have spoken, for I am sure he could have told us many interesting adventures. He would probably have told us that winter was coming, and with it heavy snows in the North which would cover up all the weeds and seeds on which he depends for food, and that he was traveling toward the South where the snows are not so deep and where some of the weeds remain above the surface all winter. Like his other brothers he is afraid to travel during the day, when his enemies, the hawks, are hunting; therefore he flies with many others at night. On clear nights he flies very high, but on this cloudy night he had come close to earth so as to follow the landscape.

The junco could have told us how, in the spring, he had journeyed northward far up into a Canadian wood where he had found a place beneath a tangle of brush to build his nest and rear his family; and how, with the oncoming of cold weather, he had started southward where he knew he could find plenty of food.

This bird is most abundant in New York State during the spring months of March and April, and again in the fall during October and November, when he is traveling to and from his nesting ground. But if the snows do not become too deep he stays with us all winter, feeding about our doorsteps and along our fence rows. Oftentimes he travels in company with the tree sparrow, and a little careful search will reveal him in almost any weedy spot that is sheltered from the wind. The junco can easily be distinguished by his blackish color, the tree sparrow being brown.

When you find a flock of juncos, watch them as they feed and learn what kind of food they prefer. A single junco destroys more weeds than will any number of boys, because he takes them in the seed; and thus all our young naturalists are saved a great deal of work.

SUGGESTIONS FOR STUDY

The whole upper parts and back of the junco are slaty black, the belly is white, the outer tail feathers are white.

Look for the junco in weedy places and patches of shrubbery, along fences and the edges of woods.

The food of the junco is composed almost entirely of seeds, with some insects in the summer. Note the heavy conical bill for crushing seeds. The junco is a sparrow and all the sparrows have this type of bill.

You will not hear the junco during the winter, but the first warm days of spring will start it singing. When you hear one, compare the song with others you have heard and learn to group the birds having similar songs. This is one of the easiest ways to learn bird songs. The junco's song resembles that of the chipping sparrow.

Note how the junco spreads its tail when it flies, so as to show the white tail feathers, which are ordinarily concealed.

Note also that you seldom see a junco far from the ground. All birds spend most of their time where they find their food, and the junco finds its food on or near the ground.

The junco that flew in at our window was migrating at night. If you have never heard the birds when they are flying at night, go out some cloudy night this October or next spring in April or May, and you will hear their chirping as they fly over. They call to one another in order to keep together.

THE CHICKADEE

ANNA BOTSFORD COMSTOCK

Of all the birds that stay with us to make cheerful our Northern winter, the chickadee is easily the favorite. No matter how cold or gloomy the day, its cheerful song and delightful personality charm us. The chickadee in winter seems friendly, and it is friendly. It devotes its entire energies all winter to hunting and eating insect eggs, or the insects tucked away in their winter quarters ready to attack the leaves as soon as they shall push out from their buds in the spring. It is particularly fond of the cankerworm eggs; and an experiment made by the Massachusetts State Board of Agriculture demonstrated that orchards to which chickadees were enticed during the winter were almost entirely free from this insect pest, while neighboring orchards were destroyed by it.

As a winter visitant, the chickadee usually appears in company with the nuthatch; and the downy woodpecker is frequently a follower of this cheerful band. The nuthatches work on the trunks and larger limbs of the trees, while the chickadees work industriously on the twigs and buds. It is interesting to see a chickadee carefully examine a twig for insect eggs. He looks it over carefully from above; then, swinging over, head downward, inspects it from below.

The chickadee is gray above; the top of the head, the nape, and the throat are black; the rest of the under parts and the sides of the head are grayish white. The chickadee can be easily distinguished from the nuthatch by its black bib; the nuthatch has a black cap, but it is white at the throat. The chickadee's beak is short and pointed, making a sharp little pick exactly fitted for getting the insect eggs and cocoons hidden away among the leaf buds. The woodpecker's beak is a long, strong chisel, fitted for cutting a passage to the burrow of the borer in the tree or to the beetle under the bark.

One of the most charming things about the chickadee is its song. Its cheerful *chick-a-dee-dee* has an inspiring quality which brings courage and cheer to the heart of the listener. In February, and as the spring advances, the chickadee sings *phœbe* more distinctly than does the phœbe bird and far more musically. The songs of the two birds may be distinguished readily. In the *phœbe* note of the chickadee, the last syllable is at least one note lower than the first, is long drawn out, and has a falling inflection; while the last syllable of the phœbe bird's song is short and has a rising inflection. The chickadee has also a cheerful little yodel, which it sings when it is very happy.

Chickadee entering its nest

The nest is built in a hole excavated in a decaying stump or post, the pair of birds working together industriously to make the excavation; sometimes a hole already made is used. The nest is oftenest made in birch stumps; the bottom is lined with fine grass, feathers, hair, or moss. The eggs, five to eight in number, are white, speckled sparingly with reddish brown. The nest is made in May.

The chickadees and the nuthatches may be induced to visit our orchards and shade trees if we put out strips of beef fat about once a month during the winter. These strips should be tied to the branches. The birds seem to regard this as a sign of friendship on our part, and will remain for hours doing their best to rid the trees near by of hidden enemies. If the suet is placed on branches that may be seen from the windows of the schoolroom, the pupils may be able to observe these interesting and useful birds every day and become familiar with their habits and economic value.

SUGGESTIONS FOR STUDY

Why does the chickadee remain in the North during the winter? Why do the robin and the bluebird go South?

Where do you see the chickadees in winter? What are they doing? What other birds are associated with the chickadees in winter? What is there in the colors and markings of the chickadee by which you can tell it instantly from the nuthatch and the downy woodpecker?

Describe the colors of the chickadee as follows: top of head, back, wings, tail, throat, and breast.

Compare the beak of the chickadee with that of the downy woodpecker, and tell why each is best adapted to procure food for its owner.

Does the chickadee find its food on the trunks of trees or on the twigs? What is the food that it finds in the North during the winter?

Describe the chickadee's actions when hunting for food.

Why is the chickadee of great value to the farmer and the fruit-grower?

How can these birds be induced to visit the orchards?

What is the chickadee's song? Did you ever hear it sing *phœbe*? At what time of year?

Where do the chickadees build their nest? Of what material is it made? When is the nest built?

What colors and marking are on the eggs?

THE WHITE-BREASTED NUTHATCH

ANNA BOTSFORD COMSTOCK

> With more artless inquisitiveness than fear, this lively little acrobat stops his hammering or hatching at your approach, and stretching himself out from the tree until it would seem he must fall off, he peers down at you, head downward, straight into your upturned opera-glass. If there is too much snow on the upper side of a branch, watch how he runs along underneath it like a fly, busily tapping the bark, or adroitly breaking the decayed bits with his bill, as he stretches for the spider's eggs, larvæ, et cetera, hidden there; yet somehow, between mouthfuls, managing to call out his cheery *quank! quank! hank! hank!*
>
> NELTJE BLANCHAN

A voice outside is calling at me; I cannot describe it accurately, but it is making delightful woodsy remarks that make me long to throw aside the pen and go out and wander where the snow is making still softer the carpet of dead leaves on the forest floor. It is not a musical note, but it is most enticing, and translates into sound the picture of bare-branched trees and the feeling of enchantment that permeates the forest in winter. Neltje Blanchan says the voice reiterates *hank*, *hank*, others say it is *nay, nay;* but no nasal sound of the human voice and no spelling of the English language adequately represents this call of the white-breasted nuthatch.

On the tree in front of the window, I can see the owner of this sylvan voice. It is a little bird, blue-gray above, with black head, black and white V-trimmings on the back of its suit, and soft white breast. It is flitting blithely from tree to tree, enjoying the snowstorm and coming often to the suet feast that I have spread for him and his little feathered kin.

My nuthatch has just now hammered off a piece of suet and thrust it into a crevice of the bark on the tree bole. Why does he do that? Is it for convenience in eating, or is it an attempt to store up some of his dinner for future need? Anyway, it is bad manners, like carrying off fruit from *table d'hôte*. But he is polite enough in another respect. Every time after eating the suet he wipes his beak on his branch napkin with great assiduity, first one side and then the other, almost as if he were sharpening it. The woodpeckers are similarly fastidious in cleaning suet off their beaks.

The loud note of the nuthatch, which seems out of proportion to the size of the bird, is by no means its only note. Yesterday we observed a pair hunting on the branches of an elm over our heads, and they were talking to each other in sweet confidential syllables, *wit*, *wit*, *wit*, entirely different from the loud note that is meant for the world at large.

The nuthatches and chickadees hunt together all winter. This is no business partnership, but one of congeniality based on similar tastes.

Thus it is that the two birds are often confused. The black throat of the chickadee, however, distinguishes it from the nuthatch at the first glance. Strange to say, the nuthatch has been confused also with the sapsucker and has gained unjust censure thereby. How any one with eyes could confuse these two birds is a mystery, for they resemble each other in no particular nor in general appearance.

Although the nuthatch finds much of its food on trees, Mr. Torrey tells of seeing one awkwardly turning over fallen leaves for hidden cocoons and other things quite worth his while; and Mr. Baskett tells of having seen these birds catch flies in the air and become quite out of breath at this unusual exercise.

Audubon made some most interesting observations on nuthatches. He says they may sleep hanging with head downward. He also says, of their nesting habits, that " both birds work together, all the time congratulating each other in the tenderest manner. The male, ever conspicuous on such occasions, works some, and carries off the slender chips chiseled by the female. He struts around her, peeps into the hole, cherups at intervals, or hovers about her on the wing. While she is sitting on her eggs, he seldom absents himself many moments; now with a full bill he feeds her, now returns to be assured that her time is pleasantly spent."

The red-breasted nuthatch is sometimes associated with its white-breasted cousin; it is a smaller bird and is essentially a northern species. The nuthatches get their name from their custom of wedging nuts and acorns into bark and then hammering or hatching them open with their strong bill. From every standpoint the nuthatches are most desirable aquaintances, and we cannot spend our time to better advantage than in becoming familiar with their interesting habits.

SUGGESTIONS FOR STUDY

Observations on the appearance of the nuthatch.— 1. What is the general color of the nuthatch above and below?

2. The colors of the top and sides of the head?

3. The color of the throat and breast?

4. Colors of bill, legs, and feet?

5. Color and markings of the wings?

6. Colors and markings of the tail?

7. What are the differences in color between the nuthatch and the chickadee?

What is the difference in shape between the bill of the nuthatch and that of the chickadee?

Facts for teachers.— The general color of this bird is bluish gray above, with white breast, and reddish beneath the tail. The top of the head and the neck are glossy black; the sides of the head are white, as is the breast. The bill is blackish and so are the legs and feet. The wing feathers are dark brown edged with pale gray. The upper middle tail feathers are bluish, like the back; the others are dark brown, and spotted with white in such a manner that when the tail is spread it has a large white patch on each side. The chickadee is gray in color, while the nuthatch is bluish gray; but the most striking difference is the black bib of the chickadee, which the nuthatch lacks entirely. The bill of the chickadee is short, " a sharply pointed little pick just suited to taking off insect eggs"; while the bill of the nuthatch is long and slender, being as long as, or longer than, the bird's head.

Observations on the habits of the nuthatch.— 1. Is the nuthatch seen most commonly on tree trunks or up in the smaller branches?

2. Does it alight on a tree trunk with head up or down?

3. When climbing a tree does it ascend in a spiral route?

4. When descending a tree does it go head downward? How does it compare in this respect with the downy woodpecker?

5. Does it use its tail as a brace when climbing a tree, as does the downy?

6. How are the nuthatch's toes arranged to enable it to cling to the trunk?

7. What is the note of the nuthatch, and has it more than one note?

8. What is its food and where is it found?

9. How does the nuthatch open an acorn?

10. Of what use is the nuthatch to the farmer and the fruit-grower?

Facts for teachers.— The nuthatches and chickadees usually hunt together, the chickadees ordinarily taking the smaller branches and the nuthatches the larger branches and tree trunks. The nuthatch is quite likely to alight head downward on a tree trunk, and it also often climbs the tree in a spiral route; it runs about over the tree so rapidly that it has been called the "tree mouse." Three characteristics distinguish this bird from the woodpeckers: it descends a tree trunk head first; its tail is short and square across the end and is never used as a brace; it has three toes directed forward, and one very long and strong one directed backward.

The common note of the nuthatch may be spelled *ank*, *ank*, or *yak*, *yak*, but these birds have for each other some very different, and very sweet, little confidential notes. While the nuthatch is fond of acorns and nuts, and also the larvæ which are the "worms" in nuts, it is also fond of all kinds of insects and spends much time hunting for those that are hidden in the bark of trees. It is therefore a help to the farmer and the fruit-grower by destroying so many injurious insects. It is comical to see a nuthatch take off a bit of suet, wedge it into a crevice in the bark, and then strike it with great force with its beak, apparently forgetting that it is not encased in a shell.

THE ECONOMIC IMPORTANCE OF THE WHITE-BREASTED NUTHATCH

H. D. REED

The white-breasted nuthatch is one of our most industrious gleaners of insects, their eggs, and their young, from the trunks and branches of trees. An individual nuthatch hustling about its work, as frequently upside down as the reverse, is the very embodiment of industry and keen scrutiny. No crack nor cranny is too insignificant to escape inspection. The nuthatch does not dig holes in the trees in search of its food as do the woodpeckers, but rather gets it from the crevices in the rough bark. In such places millions of insects deposit their eggs for safe-keeping during the winter months. The bill of the nuthatch is adapted through its shape to slip under the pieces of bark and to the very depth where eggs, and later larvæ ("worms"), are to be found. It is impossible to estimate the millions of injurious insects destroyed by a single nuthatch during a year.

Among the injurious insects devoured by the nuthatch are: beetles, which bore in the bark or wood; scale insects, among which is the oyster-shell bark-louse, injurious to apples and pears; cankerworms; and the caterpillars of the gypsy moth. A single stomach of the nuthatch in one instance proved to contain one thousand six hundred and twenty-nine eggs of the fall cankerworm. Granting that half of these eggs would produce females, which in turn would lay a large number of eggs, some idea can be gained of one day's service of this bird to man There are other insects which would probably become pests were it not that they are held in check by the nuthatch.

During the winter months the nuthatch feeds to a large extent on the seeds of weeds, thus adding to its right to life and protection. There is no doubt that this bird is to be considered the friend and colaborer of the forester, the fruit-grower, and the farmer, and in return for its very efficient service it deserves encouragement and protection.

THE DOWNY WOODPECKER

Anna Botsford Comstock

We need only to watch intelligently this little black and white woodpecker for two or three days, to learn to call him friend; and thus, wherever he has lived, he has earned the name of Friend Downy. He finds the codling moth hibernating on our apple trees; he goes directly to the wood-boring beetles and their larvæ in our forest trees; and, best of all, he delights to destroy the round-headed apple-tree borers, which are very destructive to our fruit trees. Mr. Vernon Bailey, who took the pains to watch one woodpecker for a forenoon just to see what he would do, tells us that this indefatigable little bird climbed over and inspected 181 woodland trees between 9.40 a. m. and 12.15 p. m., and made 26 excavations for food. Most of these holes exposed galleries in the trunks or in the high branches, where wood-boring ants were hiding. Another downy was seen taking the larvæ of boring beetles from beneath the bark of oak trees. The bird seemed to know the exact spot at which to drill for each larva, for he always cut a small hole directly over the insect. Moreover, this little bird is so friendly that he is willing to come and work on our orchard and shade trees if we only make him welcome. He likes best of all a bit of suet tied to the limb or tacked to the trunk of a tree, and seems to take that as a sign of our good will. Our downies have so much confidence in us that they come to the window sill for their suet banquet, and refuse to be disturbed when we stand within a yard of them.

The downy woodpecker has an attractive black and white uniform. The front of the head is black and there is a black streak extending backward from the eye, with a white streak above and another below it. A broad stripe of white runs down the center of the back. The wings are black with many white spots. The middle tail feathers are black, the outer ones white, barred with black. The male has a vivid red patch on the back of the head; but his wife shows no such frivolity in her dress, and is content with plain black and white.

When searching for food, the downy woodpecker alights low down on the tree trunk and climbs upward in a jerky fashion. It never runs about over the tree, nor does it turn around and go down head first, like the nuthatch. If it wishes to go down a short distance, it accomplishes this by a few awkward, backward hops; and when it really wishes to descend, it flys off and down. Like the other woodpeckers, the downy has a special adaptation to enable it to climb trees in its own manner. In order to grasp the bark on the side of a tree more firmly, its fourth toe is turned backward so that it works as companion with the thumb. Thus it is able to clutch the bark as with a pair of nippers, two claws in front and two behind. The tail is also used as a help in ascending the tree. It is rounded in shape and the middle feathers have rather strong quills, and the ends of the tail feathers are provided with a vast number of bristly barbs which, when applied to the side of the tree, act like a wire brush with all the wires pushing downward. This explains why the woodpecker cannot go backward without lifting the tail.

Downy woodpecker

If Friend Downy has an efficient mechanism for climbing trees, it has a still more wonderful mechanism for procuring its food. When through its acute sense of hearing it detects a grub in the wood of the tree, it seizes the bark firmly with its feet, uses its tail as a brace, thrusts its head and upper part of the body as far back as possible, and then drives a powerful blow with its strong beak. The beak is especially adapted for this purpose, since it is wedge-shaped at the tip, and is used sometimes like a pick. With it a small hole may be drilled directly to the burrow of the grub. When finally the grub is reached, it would seem impossible to pull it out through a hole too small and deep to admit of the beak's being used as pincers. But the downy has a tongue just fitted to pull the grub through that little hole. The tip of the tongue is hard and horny, and is covered with short, backward-slanting hooks, which cause it to act like a spear or harpoon when thrust into the grub. The tongue may be extended far beyond the point of the beak, as the bones that support it have a very wonderful arrangement, something like a steel spring.

The downies stay with us all winter because they find plenty of food in our trees and do not need to go South, as do the birds that live on insects in their summer stages. This is one reason why the downy is especially valuable; it works for us during the whole of the year.

When spring comes, the red-capped downy thinks about marriage and housekeeping. He is a very limited vocalist, and his sharp call could hardly be made into a love song. Therefore, our downy turns drummer. John Burroughs describes the drumming of the woodpecker thus: "A few seasons ago a downy woodpecker, probably the individual one who is now my winter neighbor, began to drum early in March in a partly decayed apple-tree that stands in the edge of a narrow strip of woodland near me. When the morning was still and mild I would often hear him through my window before I was up, or by half-past six o'clock, and he would keep it up pretty briskly till nine or ten o'clock, in this respect resembling the grouse, which do most of their drumming in the forenoon. His drum was the stub of a dry limb about the size of one's wrist. The heart was decayed and gone, but the outer shell was hard and resonant. The bird would keep his position there for an hour at a time. Between his drummings he would preen his plumage and listen as if for the response of the female, or for the drum of some rival. How swift his head would go when he was delivering his blows upon the limb! His beak wore the surface perceptibly. When he wished to change the key, which was quite often, he would shift his position an inch or two to a knot which gave out a higher, shriller note."

The downy builds its nest in a hole, usually in a partly decayed tree. An old apple tree is the favorite site. It makes a fresh excavation each year. It lays four to six white eggs on a bed of fine chips at the bottom of the nest. The door to the nest is a perfect circle, about one and one quarter inch across.

SUGGESTIONS FOR STUDY

Fasten a piece of beef fat on the trunk or branch of a tree that may be seen from the schoolroom windows. While no birds may come to it at first, yet if it is kept there they will find it. The downy is sure to be one of the visitors to this banquet table, and will come every day to partake. Place each day a few of the following questions on the blackboard and let the children answer them from their own observation. The answers should be discussed during the nature-study lesson.

Describe the colors of the downy as follows: Forehead, back of the head, above and below the eye, the throat, the under parts, the back, the wings, and the tail. Note especially the color and markings of the middle and side tail feathers.

Do all downy woodpeckers have the red patch at the back of the head? Which ones do have it?

Describe how a downy climbs a tree. How does it descend? How do its actions in this respect differ from those of the nuthatch? Why does the downy wish to climb a tree?

How are the woodpecker's toes arranged so as to aid it in climbing a tree trunk? How does this arrangement of toes differ from that of other birds?

Does the downy use its tail to assist it in climbing? How is the tail fitted to assist in this process? Why does the downy have to lift its tail in order to hop backward ?

What does the downy eat and where does it find its food? Describe how it reaches the grub in the wood of the tree. What is the shape of its bill and how is it fitted for drilling a hole in wood? Describe how the downy's tongue is used in spearing the grub.

Why does the downy not go South in winter?

What note has the downy woodpecker? Does it make any other sound? Have you ever heard the drumming of a woodpecker? At what time of year? On what did it drum? What did it use for a drumstick? Why should the downy wish to drum?

Why do we call this woodpecker "Friend Downy"? What does it do to earn its title as friend? How should we protect Friend Downy and make conditions pleasant for him to live with us and rear his family in our orchards?

Where does the downy build its nest? With what is the nest lined? What is the color of the eggs?

References.— *The Woodpeckers*, F. H. Eckstorm; *Bird Neighbors*, Neltje Blanchan; *Winter Neighbors*, John Burroughs; *Useful Birds and Their Protection*, E. H. Forbush.

THE SCREECH OWL

ARTHUR A. ALLEN

It was one of those warm evenings that we sometimes have about the middle of March. Old Winter had thrown off his snowy garments and was resting awhile to catch his breath for one last effort. Spring, vanquishing him for the moment, was filling the atmosphere with a warm south breeze. We were sitting on the porch listening to the many voices of spring that were making the air resonant. The short shrill notes of the peepers, the never-ceasing, tremulous whistle of the toads, and the occasional low croak of the leopard frogs, told us of Spring's latest victory in the near-by ponds. Suddenly, from somewhere overhead, there came another note, quite different from that of the frogs and toads, and yet so much a part of the night that had we not been listening we might have missed it. A long, low, querulous whistle it was, with perhaps just a tinge of melancholy. Our little screech owl had begun his nightly rounds.

Off and on, all winter long we had heard him call; and now that spring was approaching, his notes had become more and more frequent. He had grown so bold that he even came and sat on a limb close to the veranda and answered us as we imitated his call. His feathers all ruffed up, his eyes big and round, he was the very picture of alertness. Very different did he appear when we occasionally saw him in the daytime with his feathers drawn close, his ear tufts erect, and his eyes shut. Indeed, he then resembled more an inanimate piece of bark than a live bird. Most of his days he spent in the hollow limb of an apple tree out in the orchard, where the numerous pellets of hair and bones scattered over the ground told us of the many mice he was destroying.

There are eight or nine different kinds of owls in New York State, but the screech owl is the only one that is at all common and that you are likely to find near the house. It can easily be distinguished from all the other owls by its small size and the presence of conspicuous tufts of feathers on its head, called ear tufts. The only other owl in New York State that is as small as the screech owl is the saw-whet, or Acadian owl, and this one lacks ear tufts. Any owl that you find, then, which is as small as a pigeon and has ear tufts, is a screech owl.

The screech owls do not always migrate in the fall as do most birds, but often pass the entire winter near the place of their birth. In the daytime we can generally find them in some thick evergreen, or oftener in a hole in a tree. During the winter they frequently come into our barns, or even into crevices in our houses, where their little talons prove efficient mousetraps. About the first of April they select suitable places for their nests in old woodpecker holes or in hollow limbs in the orchard. There they lay their white eggs on the chips in the bottom of the hole, without much pretense at a nest except for a few feathers.

When the eggs have hatched and there are five or six hungry mouths to fill, the little screech owl often finds it difficult to capture enough mice; and then it is that it spoils its otherwise good reputation by catching small birds. The number of small birds killed, however, cannot begin to compare with the large number of mice killed; therefore this most interesting bird is certainly deserving of protection.

SUGGESTIONS FOR STUDY

Screech owls may be found close to the trunk of evergreen trees, or, better still, in holes in orchard or other trees. One must look very closely, for they often resemble the bark of the tree.

The screech owl is as small as a pigeon, with conspicuous ear tufts.

This bird has two color phases — a red phase, in which the general color is reddish brown, and a gray phase, in which the general color is grayish. With many birds the males and the females are colored differently, but with this bird the difference in color has no bearing on the sex.

This owl lives principally on small mammals, such as mice and shrews, but it also eats insects, frogs, and small birds. It swallows its food whole and later ejects the hair, feathers, and bones in the form of oval pellets. Look for some of these pellets under a tree frequented by owls.

How do an owl's eyes differ from those of other birds?

Did you ever hear a bird fly? Did you ever hear an owl fly? Why not?

Why does the owl have such sharp claws, or talons, and such a hooked beak?

How does the screech owl help the farmer?

THE CROW

Arthur A. Allen

In New York State the crow came in with civilization. Although practically unknown while the country was covered with dense woods, he has now become one of our most abundant and best-known birds. Sociable in his nature, omnivorous in his feeding habits, sagacious in his actions, he is eminently fitted to replace the solitary raven which left us with the forests. In no place is he more at home than in the farming districts. Here he finds open country in which to feed, as well as timber sufficient to shelter his nest. He usually escapes his few enemies. It is seldom that he falls a victim to a hungry hawk or a starving owl, and he avoids even more successfully the man with a gun.

The crow is generally considered a thief and a scoundrel, and his better side is overlooked entirely. He robs the nests of smaller birds, devours a great deal of grain, and, in his zeal for hunting cutworms and grubs, uproots enough young corn to blacken his name with any farmer. Seldom is his aid in destroying insect pests and vermin appreciated, although these, if allowed to go unchecked, would do much more damage than the crow himself.

The chief fault of a crow lies in the fact that he is lazy. An omnivorous feeder, he takes whatever comes most easily — locusts, cutworms, white grubs, mice, frogs, fish, young birds, or grain. Whatever is most abundant and most easily obtained forms his diet. In this way he becomes of great assistance in checking the larger of our insect foes, for any excessive increase in their numbers means to him simply "easy food," and he feeds entirely on them until their numbers are reduced and something else is more easily obtained. It is only when other food is scarce that he does much damage to grain or young birds. Therefore, if we can protect our grain without destroying the crow, we shall be doing a service both to mankind and to nature.

SUGGESTIONS FOR STUDY

The crow usually nests in a crotch of a large tree, seldom out on a limb. The nest is composed of large sticks lined with finer twigs, grapevine bark, and the like. The material is carried in the bill, never by the feet.

Crows at feeding station in midwinter

The eggs are light green, spotted with dark green, brown, or black. They are about the size of a small hen's egg.

Young crows stay in the nest for about three weeks.

The young crows can fly fairly well, if not frightened from the nest too soon.

Experiments in feeding have shown that a young crow requires food equal to one half his own weight each day, and would eat more if he could get it.

In order to prevent crows from eating the corn, the seed is sometimes soaked in coal tar or creosote. This does not destroy the germinating quality of the corn. Soaking in coal tar has been tried more or less successfully on a large scale.

QUOTATIONS

Editors' Note.— The memorizing of good literature should be a part of every child's education. The following quotations will provide material for this in connection with the bird study for the year 1914–1915:

SONG SPARROW

A lofty place he does not love,
  But sits by choice, and well at ease,
In hedges, and in little trees
  That stretch their slender arms above
The meadow brook; and there he sings
  Till all the field with pleasure rings;
And so he tells in every ear,
  That lowly homes to heaven are near
In "*sweet-sweet-sweet-very merry cheer.*"
From *The Song Sparrow*
by HENRY VAN DYKE

CHIPPING SPARROW

I hear the sparrow's ditty
Anear my study door;
A simple song of gladness
That winter days are o'er;
My heart is singing with him
I love him more and more.
From *A March Glee*
by JOHN BURROUGHS

WHITE-THROATED SPARROW

I take my way where sentry cedars stand
  Along the bushy lane,
And whitethroats stir and call on every hand,
  Or lift their wavering strain.
From *In October*
by JOHN BURROUGHS

CANARY

High at her window in her cage
  The old canary flits and sings,
Nor sees across the curtain pass
  The shadow of a swallow's wings.
From *A Caged Bird*
by SARAH ORME JEWETT

ROBIN

Ring it out o'er hill and plain,
  Through the garden's lonely bowers,
Till the green leaves dance again,
  Till the air is sweet with flowers!
Wake the cowslips by the rill,
  Wake the yellow daffodil!
    Robin's come!
From *Robin's Come*
by WILLIAM H. CALDWELL

BLUEBIRD

The world rolls round — mistrust it not,
  Befalls again what once befell;
All things return, both sphere and mote,
  And I shall hear my bluebird's note,
And dream the dream of Auburn dell.
From *May Day*
by RALPH WALDO EMERSON

WILD GEESE

I hear the wild geese honking
From out the misty night,—
A sound of moving armies
On-sweeping in their might;
The river ice is drifting
Beneath their northward flight.
From *A March Glee*
by JOHN BURROUGHS

WILD GEESE

Hark, what a clamor goes winging through the sky!
Look, children! listen to the sound so wild and high!
Like a peal of broken bells,— kling, klang, kling,—
Far and high the wild geese cry, "*Spring! It is spring!*"
From *Wild Geese*
by CELIA THAXTER

WINTER BIRDS

From out the white and pulsing storm
  I hear the snowbirds calling;
The sheeted winds stalk o'er the hills,
  And fast the snow is falling.

Like children laughing at their play
  I hear the birds a-twitter,
What care they that the skies are dim
  Or that the cold is bitter?

On twinkling wings they eddy past
  At home amid the drifting,
Or seek the hills and weedy fields
  Where fast the snow is sifting.
From *Snowbirds*
by JOHN BURROUGHS

CHICKADEE

When piped a tiny voice hard by,
Gay and polite, a cheerful cry.
Chic-chicadeedee! saucy note
Out of sound and merry throat,
As if it said, "*Good day, good sir!*
Fine afternoon, old passenger!
Happy to meet you in these places,
Where January brings few faces."
From *The Titmouse*
by RALPH WALDO EMERSON

NUTHATCH

The busy nuthatch climbs his tree,
Around the great bole spirally,
Peeping into wrinkles gray
Under ruffed lichens gay,
Lazily piping one sharp note
From his silver mailed throat.

From *In the Haunts of Bass and Bream*
by MAURICE THOMPSON

DOWNY WOODPECKER

Downy came and dwelt with me,
Taught me hermit lore;
Drilled his cell in oaken tree
Near my cabin door.

Architect of his own home
In the forest dim,
Carving its inverted dome
In a dozy limb.

Carved it deep and shaped it true
With his little bill;
Took no thought about the view,
Whether dale or hill.

From *The Downy Woodpecker*
by JOHN BURROUGHS

OWL

Mourn not for the owl, nor his gloomy plight;
The owl hath his share of good;
If a prisoner he be in the broad daylight,
He is lord of the dark greenwood!

From *The Owl*
by BRYAN WALLER PROCTOR

CROW

My friend and neighbor through the year,
Self-appointed overseer

Of my crops of fruit and grain
Of my woods and furrowed plain,

Claim thy tithings right and left,
I shall never call it theft.

From *The Crow*
by JOHN BURROUGHS

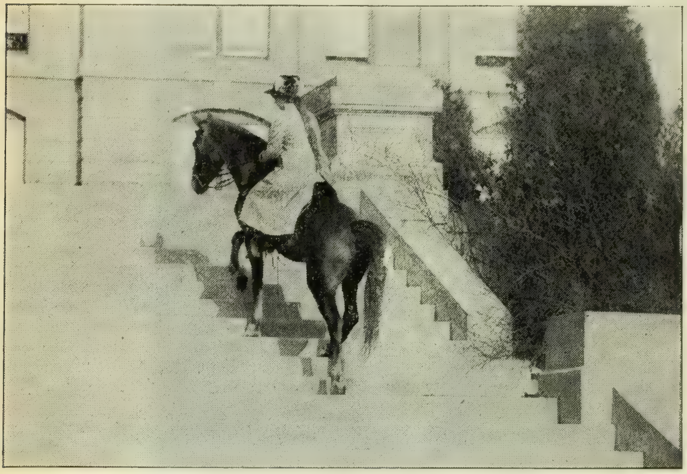
ANIMAL STUDY

THE EDITORS

Feeding the turtle. Pets are valuable in the education of boys and girls

Boys and girls in country districts have much to do with the animal life on the farm, and this is valuable in their education. The home work should be supplemented by lessons at school that will give added interest to the daily home tasks. The feeding, housing, and general care of poultry, of horses, cattle, and other animals, provide material that will give life to many lines of school work. Young persons should be taught the importance of their responsibility to domestic animals, and to consider what this may mean from the standpoint of the animals.

This year we are republishing the material that has been collected as a background for teaching boys and girls to take an intelligent interest in horses. If teachers in rural districts will carefully read the material in this publication, and use it in connection with actual observation, they will possess a good background for directing the observation of boys and girls. We know rural schools in which a horse has been taken to the school grounds for an hour, during which time the owner has taught the children some useful information about it. In preparation for such an occasion, the teacher may give the owner of the horse this leaflet to read, and ask him to select from it any lessons that may be presented to the boys and girls. Such an experience will give more opportunity for good teaching than any amount of text studied and recited in the schoolroom. On another occasion the teacher might take the class to visit a farm where there are good horses.



A pet horse mounting the steps of a campus building

Some teachers have planned a definite time in the year for the study of a special form of animal life. For instance, they have announced that every pupil will make a contribution to a Friday afternoon exercise on the horse, and during the intervening week, or two weeks, the children have collected information and material that gave life to the experience. Farmers have helped, and by the end of the exercise the children have received a considerable amount of education in their quest for knowledge about horses. A real horse, brought to the school yard as a contribution to such an exercise, will be valuable. If there should be an opportunity to have a draft horse and a carriage horse, this would add; and in some cases a Shetland pony might provide a new interest and a new awakening for the work. In the average rural school district, however, one horse will probably be all that will be available for this purpose, and this will be sufficient. The lesson may be supplemented by an exhibition of samples of feed, by-products, compositions, drawings, books, pictures, and the like.

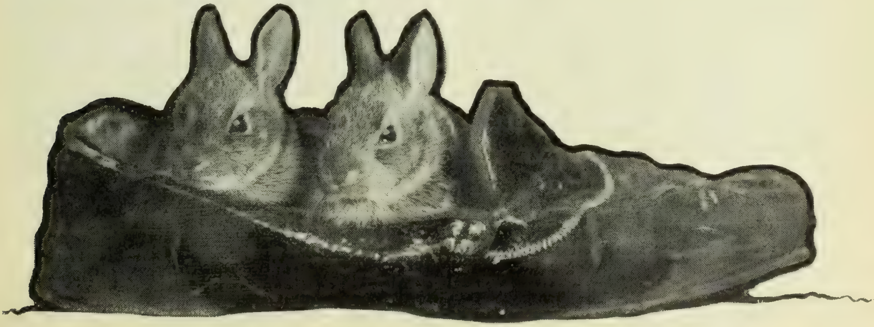
The syllabus suggests that this year special attention be given to the study of the dog. Almost every farm home has a dog. There is excellent opportunity to study its habits, and particular attention may be given to the attitude that men, women, boys, and girls should take toward a dog. It is true that much can be done in training a dog, and often a lack of knowledge is the cause of the spoiling of a fine animal. Boys and girls should learn to be firm, yet kind, and to refrain from unnecessarily annoying the animal, for such treatment often produces an irritability and snappishness that may be justifiable. A well-treated dog is one of the best companions. Perhaps the school children may be interested to learn Steven C. Foster's beautiful song, " Old Dog Tray."

The other forms of animal life given in this year's work will create much interest, and whenever possible the children should have the pleasure and profit of watching the animals at school. Rabbits are interesting, and nearly always some one in the neighborhood owns one and will be glad to have it spend a day at the school. For such an experience a terrarium is valuable. See page 1490.

A cat is easily obtained, and it is most important that the children should have an appreciation of its habits and realize the harm that cats do to bird life. One hesitates to say that the cat must go, because it is the only pet that some children ever have; but if it is allowed to remain, we must see that the children are taught to control it, especially during the nesting season. See page 1375.

Squirrels will become tame, and often the children can watch them in the school yard. Discuss the making of a cage for these active animals with the boys and girls, and let them consider it from the squirrel's standpoint.

In some schools wild mice have been used for lessons. They are much more interesting than white mice, and will become very tame. They should not be kept in a cage for a long time.



DOGS

ANNA BOTSFORD COMSTOCK

Since in a state of nature dogs run down their prey, it is to be expected that they should be equipped with legs that are long, strong, and muscular. The cat, which jumps for her prey, has much more delicate legs, but has powerful hips that enable her to leap. The dog's feet are much more heavily padded than those of the cat, and therefore in running he need not stop to save his feet. Hounds often return from a chase with bleeding feet, despite the heavy pads, but the wounds are usually cuts between the toes. The claws are heavy and are not retractile; thus they afford a protection to the feet when the animal is running, and they are used also for digging out game which burrows into the ground. The claws are not used for grasping game, as are those of the cat, and are used only incidentally in fighting, while the cat's claws are her most important weapons. It is an interesting fact that Newfoundland dogs, which are famous swimmers, have their toes somewhat webbed.

Gray wolf

The dog's body is long, lean, and very muscular, a fat dog being usually pampered and old. The coat is of hair, not of fine fur like that of the cat. It is of interest to note that the Newfoundland dog has an inner coat of fine hair comparable to that of the mink or the muskrat. When a dog is running, his body is extended to its fullest length; in fact, it seems to lie flat, the outstretched legs heightening the effect of extreme muscular effort of forward movement. A dog is master of several gaits; he can run, walk, trot, bound, and crawl.

The iris of the dog's eye is usually of a beautiful brown, although this varies with breeds; in puppies the iris is usually blue. The pupil is round, like our own. It is not arranged with a slit, as is that of the cat, and therefore dogs cannot see well in the dark; but in daylight they have keen sight. The nose is even more efficient than are the eyes, and it is on the sense of smell that the dog depends for following its prey and for recognizing friend and foe. The damp, soft skin that covers the nose has in its dampness the conditions for carrying the scent to the wide nostrils, which are situated at the most forward part of the face, and thus may be lifted in any direction to receive their marvelous impressions, so completely beyond our comprehension. Think of being able to scent the track of a fox made several hours previously! Not only to scent it, but to follow by scent for many miles without ever having a glimpse of the fleeing foe! In fact, while running, the dog's attention seems to be focused entirely on the sense of smell, for I have seen hounds pass within a few rods to the windward of a fox they were chasing without observing him at all. When the nose of any of the moist-nosed beasts, such as cattle and dogs, becomes dry, it is a sign of illness. A light fall of damp snow gives the dog the best conditions for following a track by scent.

Collie

A hound when on the trail will run until exhausted. There are many authentic observations which show that hounds have followed a fox for twenty-four hours without food and probably with little rest.

Saint Bernard

The dog's weapons for battle, like those of the wolf, are his tushes. With these he holds and tears his prey; with them he seizes the woodchuck or other small animal through the back and shakes the life out. In fighting a larger animal the dog leaps against it and often incidentally tears its flesh with his strong claws; but he does not strike a blow with his foot, like the cat, nor can he hold his quarry with it.

Dog's teeth are especially fitted for their work. The incisors are small and sharp; the canine teeth, or tushes, are very long, but there are bare spaces on the jaws so that they are able to cross past each other; the molar teeth are not fitted for grinding, as are the teeth of a cow, but are especially fitted for cutting, as may be noted if you watch the way a dog gnaws bones, first gnawing with the back teeth on one side and then on the other. In fact, a dog does not seem to need to chew anything, but simply needs to cut his meat in small enough pieces so that he can gulp them down without chewing.

Of all domestic animals, the dog is the most nearly human in expressing emotions. If delighted, he leaps about giving ecstatic little barks and squeals, his tail in the air and his eyes full of happy anticipation. If he wishes to be friendly, he looks at us interestedly, comes over to smell us in order to assure himself whether he has ever met us before, and then wags his tail as a sign of good faith. If he wishes to show affection, he leaps on us and licks our face or hands with his soft, deft tongue, and follows us jealously. When he stands at attention he holds his tail stiff in the air and looks up with one ear lifted. When angry he growls and shows his teeth, and the tail is held rigidly out behind as if to convince us that it really is a continuation of his backbone. When afraid he whines and lies flat on his belly, often looking beseechingly up toward his master as if begging not to be punished; or he crawls away out of sight. When ashamed he drops his tail between his legs and with drooping head and sidewise glance slinks away. When excited he barks, and every bark expresses high nervous tension.

Almost all dogs that chase their prey bark when so doing, which would seem at first to be a foolish thing to do, since it reveals their whereabouts to their victims and also adds an incentive to flight. But it must be borne in mind that dogs are descended from wolf-like animals, which naturally hunt in packs and do not stalk their prey. The baying of the hound is a most common example of this habit, and when we listen we can understand how by following this sound the pack is kept together. Almost all breeds of dogs have an acute sense of hearing. When a dog bays at the moon or howls when he hears music, it is doubtless a reversion to the wolf habit of howling to call together the pack or in answer to "the music of the pack."

HORSES

The Editors

A HORSE is one of the best subjects for the study of animal life. Children can obtain knowledge of horses at first hand in both city and country. The ideal beginning of this study would be to have a horse in the school yard or in front of the schoolhouse, and have the teacher or some farmer in the neighborhood give a lesson, demonstrating facts from life as the lesson progresses. A lesson given in one school was most interesting because the horses of different types in the community were arranged in front of the schoolhouse while the discussion of horses took place. This would be possible in many schools.

Added interest might be obtained in giving this series of lessons on horses by the use of stories connected with them — discussion of the training of fire horses, stories of intelligence shown by horses under many different conditions, and the like. The humane treatment of horses should also be taught.

Before any of the facts in the following lessons are taken up for the schoolroom it would be well to have the children make some observations for themselves. The following list of questions might be placed on the blackboard and the children encouraged to try to find out answers to the questions. Ask them to make personal observations, and in order to answer some of the questions to consult men in their community who have worked with horses. The questions given in the lesson are not more essential than others if the teacher would prefer to prepare some other list. All questions for nature-study lessons should be such, however, that the children will be interested to find out the answers by watching the horses if possible.

Questions

1. Where is the horse's knee joint? Which way does the knee bend?

2. Where is its hock joint? Which way does it bend?

3. Can a horse sleep when standing?

4. How are the legs placed when a horse lies down?

5. How does a horse get up — front legs first or hind legs first? How does a cow get up?

6. When a horse starts, after having stood, what foot does he put forward first — the left or the right? fore or back? What foot moves next?

7. When a horse trots, do the two feet on one side move together, or do lefts and rights move together?

8. What does a driver mean when he says that a horse "forges" or "overreaches"?

9. Name the things that a horse commonly eats. What is a good feed for a day — how much of each food and when given?

10. How did the horse first learn to paw?

Answers

M. W. HARPER

1. The knee joint is situated a little over halfway down the front leg, between the forearm, which is above, and the cannon, which is below. It corresponds to the wrist of a man.

The knee joint bends backward.

2. The hock joint is situated about halfway down the hind leg, and is analogous to the ankle of a man.

The hock bends forward.

3. A horse can sleep standing, and will do so rather than lie in an uncomfortable place unless there is something the matter with his feet or he is very tired.

4. When a horse lies down, he draws the four feet together under the body, lowers the head, bends over his knees until they touch the ground, and gently falls over on the side, the right or the left. He may now assume one of two positions: first, if on the right side, he rests on the chest and the abdomen with all four legs half bent and drawn up toward the abdomen, the head and neck swung to the left and probably resting on the limbs or against the abdomen; second, he may lie flat on his side, with head, neck, body, and legs all stretched out on the ground.

5. To rise, the horse raises the head and neck, extends the fore legs in front of him, and raises himself part way up on them; in the meantime he has placed his hind feet on the ground a little removed from the abdomen; then by a quick effort he brings himself up on his feet.

When a cow rises, she lowers her head and neck, rests her fore quarters on her knees, raises herself on her hind feet, then by a quick effort rises to her fore feet.

6. A horse, in starting to walk after having stood, may start off with either his right or his left foot. In case he starts off with his left front foot, almost at the same time he raises his right hind foot. At the walk, a horse moves on diagonal feet.

7. When a horse trots, he moves his right front foot and left hind foot together. At the trot he travels on diagonal feet.

When a horse paces, he moves on his right front foot and right hind foot at the same time. At the pace he travels on lateral feet.

8. When a horse forges, the toe of the hind shoe strikes the shoe of the fore foot on the same side.

When a horse overreaches, the shoe of the hind foot strikes the front foot in such a way as to cut or inflict a wound.

9. The foods given to a horse vary according to the locality. In the Northern States, Indian corn or oats constitute the grain part of the meal, while cornstalks or timothy hay constitute the coarse part of the fodder. In the South, Indian corn is the common grain, and dry corn stalks the coarse material. On the Pacific Coast, barley is the grain, and wild oats, or barley and wheat plants, the coarse material. Wheat bran is also a very good food, and should never be dispensed with in feeding the horse—especially the driving horse, which is likely not to be regularly driven. There is nothing better than sound oats, Indian corn, and wheat bran for the grain part of the meal of a horse; and there is nothing better than sweet timothy, or mixed timothy and clover hay, free from dust, for the coarse part of the ration.

The number of pounds to be fed per day cannot be stated with exactness. That will depend on the kind of food, as well as on the size of the horse and the kind of work that he is called on to do. We may say that a horse of the average size doing light work will consume daily twenty pounds of dry matter, water-free; one doing medium work, twenty-four pounds; and one at heavy work, twenty-six pounds. One half to two thirds of this dry matter should be grain, the remainder coarse fodder. The proportion of grain that should be fed depends on the kind of work that the animal is doing. When the horse is at hard work, the grain should be increased and the hay diminished; when he is idle, the hay should be increased and the grain diminished.

The portion of the day's allowance that should be fed at each meal can be stated with more exactness than can the quantity. The animal should be fed three times a day, having one quarter of the day's allowance at least one hour before going to work in the morning. When the morning's task is over, he should be watered, then fed another quarter of his allowance, and watered again on the way to work. When the day's work is done, he should be watered, then fed the remainder of the food, which will be one half of his day's allowance. The reason for the large meal at night is that he now has ample time to masticate and digest his food. He should be unharnessed at once, and, when the sweat has dried, should be given a thorough brushing. A horse cared for in this way will come from the stable full of vim and energy, and ready to attempt any task that he may be called on to do.

10. The horse is a native of a cold climate, in which it pawed the snow off the forage.

A FIRST LESSON ON THE HORSE

M. W. Harper

Every farm boy, and every girl, too, for that matter, should know what characters constitute a good horse—what makes a horse wanting in form, what makes it desirable. The various parts of an animal when studied in detail exhibit dimensions of length, breadth, thickness, and direction. It is in part because of these general relations, or proportions, that we distinguish, at first sight, a horse from a zebra. These proportions may be good or bad. If good, the animal is said to be well formed, or to have a handsome form; if bad, he is said to be wanting in form, or not handsome.

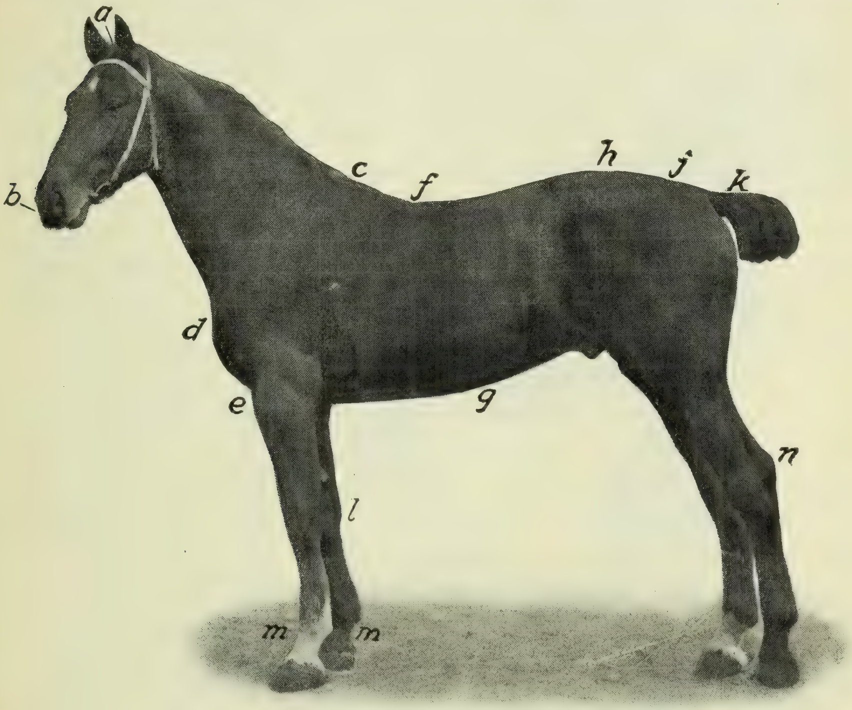
In a study of these relationships, or proportions, we must take some part as a unit, or standard of measurement. The head of the horse is most used for this purpose, because it is the most noticeable, its length is easily obtained, and variations are more rare than in other parts. If we take the total length of the horse's head, from the tip of the lips to the top of the poll, and compare it with the body of a well-formed horse, we shall find that there are four other measurements almost exactly equal to it, as follows:

1. The length of the neck, from the top of the withers to the poll. If there is much difference between these measurements, we say that the head is too long or the neck is too short.
2. The height of the shoulder, from the top of the withers to the point of the shoulder.
3. The thickness of the body, from the middle of the abdomen to the middle of the back.
4. The width of the body, from one side to the other. If there is a great variation in these measurements, we say the horse has a poor form.

A horse must be in harmony with his surroundings. A light harness horse, which is attractive when hitched to a light runabout, would appear very much out of place if hitched to a heavy draft wagon; whereas the ponderous draft horse would seem in place when hitched to such a wagon and would appear very much out of place when hitched to a light runabout. In order to appreciate the beauties of a well-formed and handsome animal, we must place him in surroundings in keeping with himself. In this connection, the height and length of the horse assumes some importance, as it is not an uncommon sight to see a small horse hitched to a large buggy or to see a large horse hitched to a light buggy.

In either case the appearance of the horse is criticized; yet the animal may be very well-proportioned.

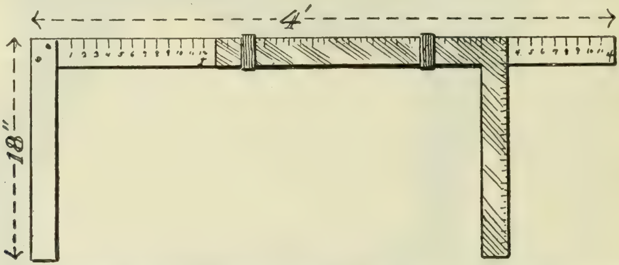
It has been observed that there is a relation between the parts of the horse's body. We have seen that the length of the head is almost equal to the width and depth of the body, as well as to the length of the shoulder and length of the neck. Now we are to point out the relationship between the *length of the head*, the *total length of the body*, and the *total height of the body.* Take the length of the horse's body by placing the stationary end of the bar described below against the point of the elbow, then slide the square along the bar until it reaches the back of the buttock. You will find the distance equal to almost two and one half times the length of the head.



A well-proportioned horse: a, poll; b, lips; c, withers, or shoulder lops; d, point of shoulder; e, chest; f, back; g, abdomen; h, hips; j, rump; k, buttock; l, knee; m, fetlock joini; n, hock

There are two points from which we measure the height: first, from the highest point of the withers to the ground, and second, from the highest part of the rump to the ground. If we take the height from the highest point of the withers, by placing the stationary end of the bar on the ground and sliding the square up the bar until it reaches the top of the withers, we shall find this distance equal to almost two and one half times the length of the head. If we take the height of the horse from the highest point of the rump to the ground, this distance will also be found to be almost two and one half times the length of the horse's head. Thus we can find three measurements equal to two and one half times that of the head: (1) the length of the horse's body from the point of the elbow to the buttock; (2) the height from the withers to the ground; (3) the height from the rump to the ground.

Since some of the good points of the horse are judged by proportion, the children may make an instrument for taking measurements, as follows: Procure a piece of soft white pine two inches wide, one half inch thick, and four feet long; to one end of this, and at right angles to it, tack securely a similar piece of pine eighteen inches long; to the other end strap loosely an ordinary carpenter's square so that it may slide back and fourth. Now mark off the long piece in inch and half-inch lengths, beginning at the inside of the stationary bar. A yardstick may be used for making the measurements of the horse, but in order to have them accurate the instrument should be made.



Instrument for measuring horses. Four feet long, eighteen inches wide

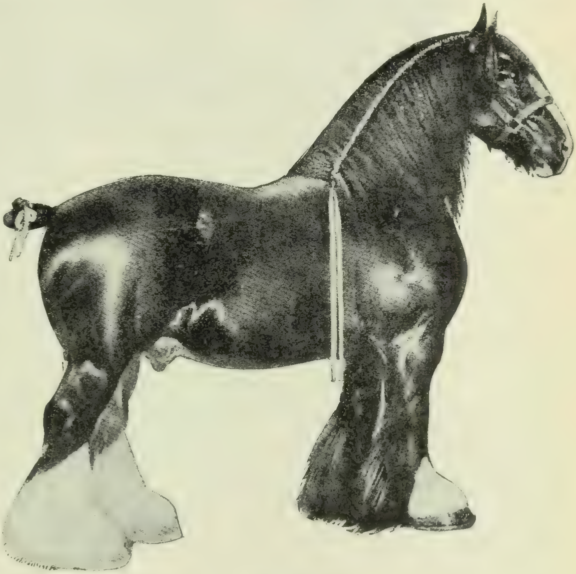
Editors' Note.—Having made the instrument for measuring horses, it may be a good exercise for the boys and girls to take turns using it in measuring the horses on their home farms and on neighboring farms in the community with which they are familiar. This should follow the exercise at the school which has taught them how to take the measurements, and careful records should be kept of the proportions of the different horses measured at home. In this way it will be possible to determine fairly closely the best-proportioned horse in the neighborhood, and the horses that most nearly approach it. It would also be valuable, once this information is obtained, to know more about the horses that are most nearly perfect in form, finding out something of their past history, their value, whether they are in good condition, the care that is taken of them, and like matters of interest. It will usually be found that good proportion is directly connected with good breeding.

TYPES OF HORSES

M. W. HARPER

By comparing the horses that we see, we observe that they are of different forms or types. Some possess a form that enables them to draw very heavy loads, but at a slow pace. Some are so formed as to draw light loads and at a very rapid pace. Between these two extremes we may observe a form that is intended to draw a very moderate load, but with high action and much style. These are three distinct types and they are called *draft horses*, *driving horses*, and *coach horses*.

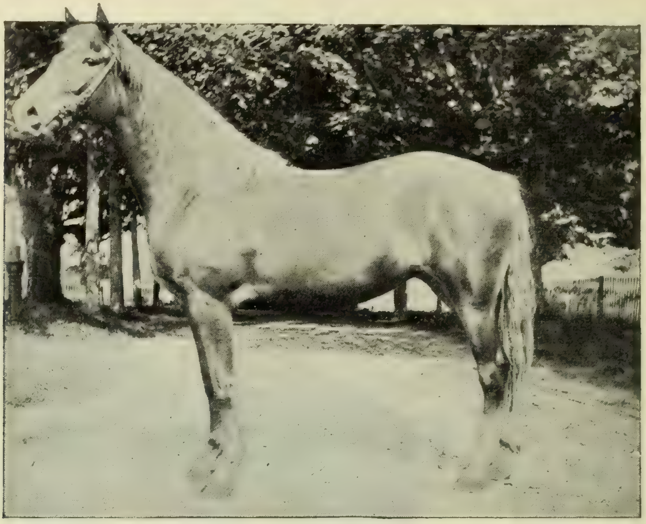
You will observe that the draft horse has short legs, a heavy body, a short, thick neck, a broad, deep chest and shoulders, strong hocks, and rather large joints and feet. With the draft type, weight is one of the most important considerations, for a true draft horse must be heavy as compared with the coach horse or the driving horse. A draft horse in fair condition may weigh anywhere from fifteen hundred to two thousand pounds or more. The greater the weight, as a rule, the more efficient the draft horse. If you will watch the draft horse as he draws a heavy load, it will become very evident that the heavy horse in harness brings greater power into the collar than does the light one.



A draft horse

There are several different breeds of draft horses. The Percherons, Belgians, English Shires, and Clydesdales, are probably the most familiar. The Percherons came from France, and at first they were gray. Now the blacks are in the most favor. The Belgians, usually chestnut or bay, came from Belgium. The Shires, commonly bay, brown, or sorrel, came from England. The Clydesdales, very similar in appearance to the Shires but often smaller and more active, came from Scotland.

The driving horse has a longer and more graceful neck, a narrower chest, a longer body, and longer legs, than the draft horse. Weight is not so important in the driving type as in the draft type. Speed and endurance seem to be the principal points sough+ in the roadster, or driving horse, and less uniformity is found in this type than in the draft or the coach type. The driving horse varies widely in height, weight, and conformation. In conformation this type tends to be angular, the muscles and joints showing prominence, with the ribs more or less noticeable. There is relatively less body and more legs, and a thinner neck, with muscularity at the croup and quarters. The American trotter or pacer is the common type used for this work. These horses are bay, black, brown, roan — in fact they are likely to be almost any color.



A driving horse

The coach horse, or carriage horse as it is frequently called, is intended for the special purpose of drawing coaches and other fashionable vehicles, such as are commonly seen on the streets of every city. In general appearance the coach type shows smooth, graceful lines, with a general fullness in all parts. The neck is of moderate length and gracefully arched, the shoulders are long and sloping well into the back, the body is round, short on top and long below, and the legs are of good length, showing cleanness, good bone, and plenty of muscle. In this type of horse, style and action are the most important factors. The coach type of horse should possess rather high, bold knee action of a flashy sort. The hocks should be slightly bent, or flexed, and the legs carried well up to the body when in action.

There are several breeds of coach horses, the hackneys, the French coach, and the German coach being the best known. Of these, the hackney is perhaps the most desirable as a coach horse because of his high action and pleasing style. The hackney came from England, where for centuries he has been greatly patronized as a saddler and a roadster. In color the hackney varies; chestnuts are at present in the greatest demand. The French coach came from France. In color this type varies considerably, bays and browns being the most common. The German coach came from Germany, where these horses have been bred for centuries. In color they are usually bay, black, or brown.

A coach horse

One must not get the idea that all the horses he observes on the street will fall into one of these three types, for the horses that one usually sees are common horses of no particular type and are used for a great variety of purposes. These common horses have not been bred true to any type, but are oftentimes the result of crossing the various types mentioned, or are descendants of common horses. They are not so efficient for any given purpose, and are not so valuable, as when bred true to a given type.

ESTIMATING AGE IN HORSES

M. W. Harper

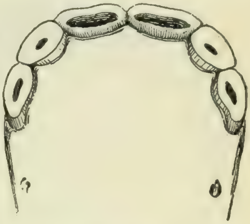
One of the most important factors in determining the present and prospective value of a horse is his age. His continued usefulness depends on his age. Familiarity with the characters that most certainly indicate age is, therefore, often extremely useful. A knowledge of these characters is not difficult to obtain, but skill in their application depends much on familiarity and continued practice.

For estimating the age of the horse, the teeth furnish the best index; yet there are other general considerations that play an important part, especially in the case of very young and very old animals.

General considerations.— In colts the bones of the face and the lower jaw have a full, rounded appearance, because the roots of the teeth extend far into the bone. The face gradually becomes more concave on the sides, the lower jaw thinner from side to side, and the lower edges much sharper. This is because the teeth are much more deeply incased in the jawbone of the younger animal. Little by little the teeth are pushed from their sockets in order to compensate for the loss occasioned by the friction of mastication, and at the same time the two borders of the lower jawbone are drawn toward each other. In very old horses, white hairs make their appearance around the temples, the eyes, and the nostrils; the poll, or top of the head, becomes more pointed; the sides of the face grow more depressed; the supra-orbits, or hollows just above the eyes, are more hollowed out; the backbone becomes more prominent; and the animal does not stand squarely on his legs. Bear in mind, these considerations are general in their nature and to be considered as a whole. Each taken alone is of little or no use; but when considered in connection with the age indicated by the teeth, they help to confirm one's conclusions as to the age.

Estimation of age by the teeth.— While the appearance of the teeth is considered the most nearly accurate means of estimating the age of the horse, yet this is not absolutely accurate, since other conditions, as well as the individuality of the animal, must be taken into account. The texture of the horse's teeth, his feed, and his breeding may influence the amount of wear on the teeth.

Since one is seldom called upon to estimate the age of a colt under two and a half or three years of age, we shall pass rapidly over the earlier period. The horse is provided with two sets of teeth — the milk, or baby, teeth and the permanent teeth. The first, or middle, pair of the milk teeth appears when the colt is about one week old; the second, or intermediate, pair, at the end of one to two weeks; and the third, or lateral, pair, when the colt is about one month old. These baby teeth are long from right to left and have well-defined "cups." These cups are small, hollow depressions in the middle of the teeth.

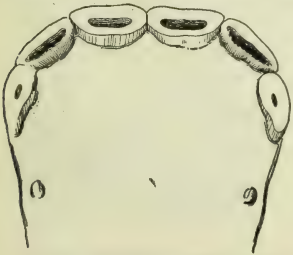


Lower nippers at three years of age

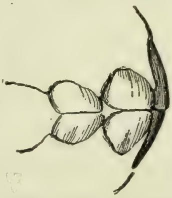
Two and a half to three years old.— When the colt is about two years and nine months old the central permanent teeth will appear, and at full three years of age the outer part of the teeth, and sometimes the inner also, will be up and in wear. These permanent teeth are larger in every way than the milk teeth. At this age the intermediate milk teeth have worn down and lost all, or nearly all, of their cups. There will be a slight black indentation that can hardly be called a cup. In the lateral, or corner, teeth, the cups are greatly reduced; if the colt is a male, small caps are likely to be present or in the process of coming through the skin of the jaw. These are called tusks.

Four years old.— When the colt is about three years and nine months old the intermediate permanent teeth appear. At four years of age, they are fully up and in wear on the inside and sometimes on the outside. The central teeth show one year's wear. The cups are not so deep as they were when the colt was three years old. The cups have nearly or quite disappeared from the lateral, or corner, milk teeth, often nothing but a slight dark indentation being left. The tusks, if any, have enlarged, but are still sharp at their points and flattish on the inside. The crowns of the two milk teeth, one upper and one lower, come together closely over their entire surface, while the two permanent teeth do not meet at their back corners.

Five years old.— When the horse is about four years and nine months old the permanent corner teeth make their appearance. When full five years of age, the outer exterior parts of the teeth meet, although almost one year of wear must take place before the lateral, or corner, teeth are worn level over their entire surface. At five years of age the horse has a full set of teeth, and the central teeth have two years' wear. They have also changed slightly in shape, having become rounder on the inside. The intermediate teeth show one year's wear. The cups show in all the teeth, but are deepest and freshest in appearance in the corner teeth. The tusks have enlarged, but are not yet blunt.

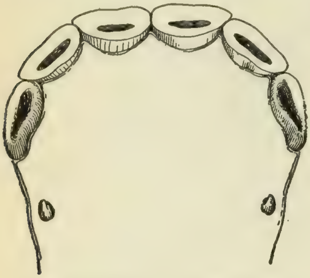


Lower nippers at four years of age

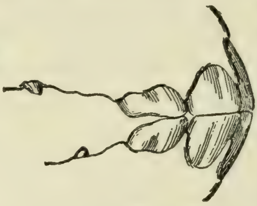


Side view of the teeth of a four-years-old horse

Six years old.— When the horse is six years of age, the cups in the lower jaw have disappeared, or nearly so, from the central teeth and have become smaller in the intermediate teeth, and the corner teeth are up and in full wear over their entire surface. Sometimes, however, a horse has shelly teeth, in which case the inside corner teeth may not be up and in wear; in fact, they may never come up, but always have the appearance of corner teeth that are not fully up. The center teeth have made marked changes in shape, becoming roundish on the inside, and the intermediate teeth are also somewhat modified. If the horse's lips are parted and the mouth is viewed from the front, it will be noted that the central teeth will appear much darker-colored and longer than they did when the horse was three or four years old. This is due to the shrinking, or receding, of the gums.



Lower nippers of a five-years-old horse

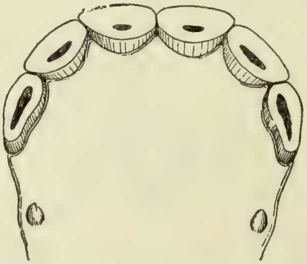


Side view of the teeth of a five-years-old horse

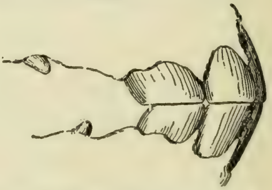
Seven years old.— When the horse is seven years of age, the cups have disappeared from the intermediate teeth, although small dark spots may often be seen. The corner teeth still retain their cups, although they are quite shallow.

The side view of a seven-years-old mouth shows one marked characteristic. The lower corner teeth seldom extend as far backward as the upper ones do. Only in rare cases do all four corner teeth meet accurately. The result is that the face of the tooth in the rear recedes, while that part of the tooth not in wear projects downward, forming more or less of a notch.

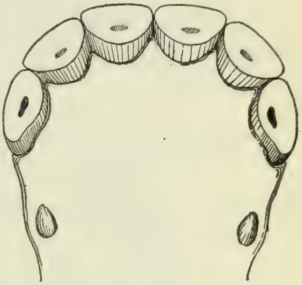
Eight years old.— When the horse is eight years of age, the cups have disappeared from the teeth in the lower jaw. One must not be misled by the slight dark-colored indentations that are still present, for they are not deep enough to be called cups. It is well to bear in mind that the period from the time when the teeth in the lower jaw are well up and in wear to the time when the cups have disappeared



Lower nippers of a six-years-old horse



Side view of the teeth of a six-years-old horse in the lower jaw, is three years. The shape of the tooth has undergone marked changes. At first the teeth were thin from outside to inside, and comparatively broad from right to left, while now they are much thicker from inside to outside. They have become more triangular in shape. If viewed from the side, they will appear somewhat longer and will meet at a sharper angle than they did when the horse was younger. As years go by, the angle of the teeth increases. When the horse is three years of age, the upper and the lower teeth meet nearly vertically, while at twenty they meet at an angle of nearly forty-five degrees.

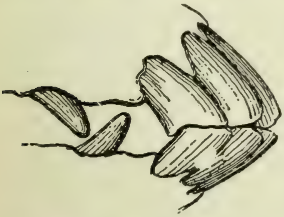


Lower nippers of an eight-years-old horse

Nine years old.— The teeth in the upper jaw retain their cups for a much longer time — in fact, just twice as long, disappearing in six years from the time when they made their appearance. When the horse is nine years old the cups have disappeared from the upper central teeth and are shallow in the intermediate and fairly deep in the corner teeth. The cups are not likely to disappear at so regular intervals in the upper jaw as they do in the lower. Therefore, after he has passed his eighth year, it is not always possible to tell the age of the horse within a year or two. Horses with soft bones may have mouths appearing older than they really are, while those with hard bones may have mouths appearing younger than they are.

Ten years old.— When the horse is ten years old the cups have disappeared from the upper intermediate teeth, but are still in the corner teeth, although shallow. The teeth are more triangular in shape.

Eleven years old.— When the horse is eleven years old the cups have all disappeared from the upper jaw. However, it is not uncommon to find shallow cups in the upper corner teeth as late as the twelfth or the fifteenth year. The shape and angle of the incisors will prevent a close judge from being greatly deceived.



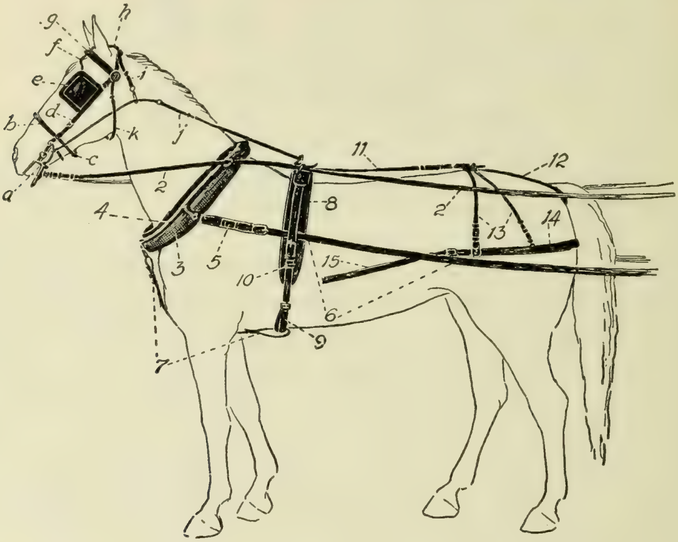
Side view of the nippers of an old horse

Later years.— After the horse has passed the twelfth year, the matter of two or three years amounts to little. Much depends on the individuality of the animal, as some animals are worth more at eighteen years than others are at fourteen. Judgment of the value of a horse at these ages should be formed on general appearance and activity, rather than on age, which cannot be accurately determined.

HARNESS AND HARNESSING

M. W. Harper

The work of the horse is accomplished by means of the harness. Properly fitted harness adds much to the efficiency and comfort of a horse.



A well-kept harness adds very materially to the general appearance of the equipment. Hence it is important to know the various parts of the harness and the use of each. A set of harness is really very complicated, and if we were asked to unbuckle the parts, mix them, and then buckle them together again there are few of us who could accomplish the task quickly and with one trial.

Names of the parts of a harness, and uses

1. Bridle — used to hold the bit in the mouth and to restrain the horse. The parts are bit, nose band, chin band, face band, blinds, winker braces, brow band, crown band, gag swivel, side check, throat latch.
2. Lines — used to control and restrain the horse.
3. Collar — used to protect the shoulder, thus enabling the horse to draw heavy loads without injuring the shoulder.
4. Hames — used to distribute weight along the collar.
5. Hame tugs — used to fasten the traces to the hames.
6. Traces — used to connect the hame tugs to the load.
7. Martingale — often used to hold the collar in place in backing a

load, and sometimes attached to the lines to hold the horse's head in position.

8. Saddle — used to protect the back from the weight of the shafts, to receive the check rein, to hold the lines and the parts of the harness in place.

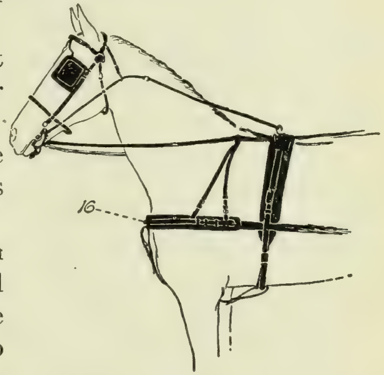
9. Girth — used to hold the harness in place.

10. Shaft tug — used to hold the shafts in place.

11. Back strap — used to hold the saddle, hip straps, and crupper in place.

12. Crupper — used to hold the hip straps, and in connection with the back band to hold the saddle in place.

13. Hip straps — used to hold the breeching in place.



14. Breeching — used in connection with backing the load.

15. Holdback straps — used to connect the breeching with the load in order to hold back and in backing.

16. Breast collar — often used in place of the shoulder collar when the load is light.

Purpose of the harness.— On reflection it is apparent that harnesses are used for two purposes: first, to enable the driver to control the horse; second, to enable the horse to control the load, to move it forward and backward. In order to control the horse the driver must gain command of the head, and this is best accomplished by the mouth, since it is well forward and tender. That the mouth is tender and easily made sore by poorly fitting bridles must not be forgotten, as many gentle horses are rendered unsafe by spoiling the mouth with a cruel, ill-fitting bridle. Hence much care must be taken in properly adjusting the bridle.

In order to enable the horse to control the load, the driver must attach the animal to the load in such a manner as to give the horse perfect control over himself. This is best accomplished by attaching the shoulders of the horse to the load; and in order to do this, collars, hames, and traces have been devised. Since the compression between the collar and the shoulder is great, much attention must be given to these parts or the shoulders will become sore also. In order to enable the horse to back the load, the breeching and holdback have been devised.

In adjusting the harness we must remember that there are four places likely to show abrasion and become sore. Poorly fitting bridles and severe bits cause sore mouths; poorly fitting collars cause sore shoulders; poorly fitting saddles, where there is much backing, cause sore backs; and poorly fitting cruppers cause sore tails. Sores thus produced give the horse much pain and are likely to cause viciousness. A sore mouth often provokes a horse to run away; sore shoulders and a sore back often provoke balking; and a sore tail often provokes kicking.

Choosing and fitting the bridle.— In the choice of a bridle the bit is first to be considered. Bits of many types have been devised to meet the various and peculiar habits of the horse. For most animals a good-sized bit cannot be improved upon. Care should be taken to see that it is of the proper length to fit the animal's mouth. After the bit has been decided upon, note the adjustment of the bridle. Sometimes the headstall is so short as to draw the bit upward into the angles of the mouth; it thus annoys the horse and may produce sore mouth. Then, again, often the headstall is too long, allowing the bit to drop. In such a case the horse becomes unmindful of the driver's wish. After the adjustment of the bridle, come the blinds. There is much discussion as to the wisdom of using blinds on bridles. Some horses work better with them; others do better service without them.

Fitting the collar.— The fitting of the collar not only is of much importance, but also is a rather difficult task. The collar is very stiff and firm, and slow to adjust itself to the shoulders. A good way to adjust the collar is as follows: Choose the most perfectly fitting collar available, place it in three inches of water, and let it remain over night. In the morning put the collar on the horse and work him moderately through the day. After having been soaked in this way the collar will adjust itself to every inequality of the shoulder, and the horse will seldom be troubled with soreness.

Fitting the crupper.— The crupper is a frequent source of sore tail, and a horse with a sore tail is often difficult to manage. This soreness is often caused by the back strap being too short, thus drawing the crupper up tight against the tail, which soon becomes abraded. In order to avoid this, see that the back strap is of the proper length, in which case there will be little likelihood of the tail being made sore.

Care of the harness.— The harness should receive proper care, as this will increase the length of usefulness and lessen the liability of its injuring the horse. The bearing parts should be kept scrupulously clean at all times. This applies particularly to collar, saddle, and crupper. It is not possible to prevent sore shoulders, sore back, and sore tail if these parts are permitted to become dirty. Because of sweat and dandruff these parts should be carefully cleaned immediately after the harness is removed from the horse's back.

Learning the various parts of the harness.— Perhaps the best way to learn the various parts of the harness, and where each part belongs, is to unbuckle the harness and take it all apart. As this is done note how each part is attached and where it comes from. Name the parts thus separated. See whether you can put each part back into its proper place.

HORSE TRAINING

M. W. HARPER

The profit and pleasure to be derived from the use of a horse depends on his being subservient to his master's will. The more complete his training, the better horse he will be. The problem is, then, so to train the horse as to bring him to his maximum usefulness.

A horse seems to have rather limited reason, but rather remarkable memory. These facts must be taken advantage of in training the animal. To begin with, there are two factors more or less opposite that must be impressed: the horse must be led to underestimate certain of his powers, and at the same time be made to believe that there is no limit to certain others. For example, the first time the horse is tied by the head, see to it that he is fastened securely and that the halter will hold in case he pulls. If the horse pulls and fails to free himself in the first few attempts there is little likelihood of his trying it later, while if he succeeds in freeing himself at first he will never cease trying to repeat what he once accomplished. On the other hand, it is very important not to overload the horse that is being trained, with a view of creating in him the notion that he can pull anything. Thus, in order to promote the horse's usefulness, we exaggerate his appreciation of those powers that are useful to man and deceive him as to certain others that are not useful and are perhaps positively dangerous.

A horse should be trained to stand still while being harnessed and hitched, and until the word to start is given. If this training is long delayed it will be very hard to give.

A horse should never be trusted more than is necessary. Many distressing accidents occur from this cause. A good horseman never runs risks when they can be avoided.

In harnessing, saddling, or handling a horse, the work should always be done from the left side. The harness should be gently, but firmly, placed on the animal. The harness and other equipment should be of good quality and in good repair.

In hitching a horse into a pair of shafts, the shafts should always be raised and the animal backed into them or the vehicle drawn forward, as the horse is likely to step on a shaft and break it if backed in while the shafts are on the ground.

In hitching, the lines should be fastened into the bits and placed where they can be easily reached, before the horse is hitched to the vehicle. In unhitching, the lines should be the last disengaged, and care should be taken that the animal is free from the vehicle before he is led away.

A horse should be tied by a strong rope or strap about the neck, the strap passed through the ring of the bit and then to the post. A horse should always be tied short, otherwise he may get his foot over the tie-strap, be unable to disengage it, break the tie-strap or check rein, become frightened, and cause an accident.

In working a horse few signals should be used. These should be used to mean exactly the same thing at all times. Signals or commands should be given gently, but firmly, and should always be carried out.

Whoa should always mean to stop, and nothing else; it should not mean to go slowly or steadily, or even to get ready to stop.

Steady should be used when it is desired to have the horse go slowly or steadily.

Back should always mean to move backward, and should not mean to stop.

Get up should always mean to move forward in case the animal is hitched.

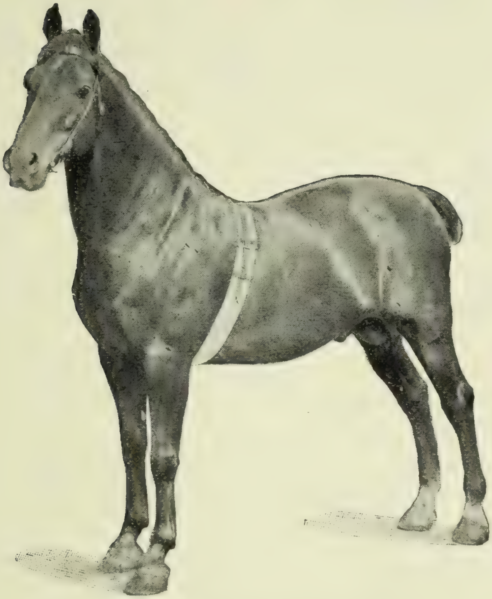
These four commands are sufficient for the animal at work. They should be spoken clearly and distinctly and should never be combined, as *whoa-back*, which is often used in the place of *whoa*.

It may be added that not all men are fitted to train horses; in fact, not all horse lovers are good horse-trainers. There is a particular adaptation possessed by those unfamiliar, as well as by those familiar, with the horse. A man possessing this particular adaptation, although unfamiliar with the horse, will in a very short time, if given the opportunity, make a better trainer than the man who is familiar with the horse but lacking the special adaptation.

Round-hoofed, short-jointed, fetlocks shag and long,
Broad breast, full eyes, small head and nostril wide.
High crest, short ears, straight legs, and passing strong,
Thin mane, thick tail, broad buttocks, tender hide;
Look, what a horse should have, he doth not lack,
Save a proud rider on so proud a back.
SHAKESPEARE

SCORE CARD FOR THE HORSE

M. W. HARPER



A horse with good proportions

The object of a score card is to familiarize a person with the various points of the horse, as well as to aid in a systematic examination. There are so many points to be considered in examining a horse that a person who has not had much experience is likely to omit some of the points if he does not have a list of them. Because of the number of points to be considered, the score card is rather long; but we feel that by giving each point a place and a value, we may enable a person to gain the desired information much more accurately, and even more quickly, than if the minor points are omitted or thrown in with the more important ones. A card on which the points are thus mixed leads to confusion.

For convenience, and in order to aid in a clearer understanding, the card is divided into five parts: general appearance, which has to do with general make-up and is often the only part considered when the inexperienced person selects a horse; the head and neck; the fore quarters; the body; and the hind quarters. Each of these parts and the points under them should be carefully noted, first collectively and then separately, for in no other way can one be sure of his choice.

SCORE CARD FOR HORSES

Scale of points	For draft			For driving		
	Perfect score	Student's score	Corrected	Perfect score	Student's score	Corrected
General appearance, 33						
Age—estimate in years by teeth	....	....	....	....	....	.....
Height—estimate in hands	....	....	....	4	....	.....
Weight—estimate in pounds	15	....	....	....	....	.....
Form—symmetrical, smooth, stylish	4	....	....	6	....	.....
Quality—skin fine, hair silky	4	....	....	4	....	.....
Temperament—kind	4	....	....	4	....	.....
Action—smooth, straight, regular	6	....	....	15	....	.....
Head and neck, 7						
Head—lean	1	....	....	1	....	.....
Muzzle—nostrils large, lips thin	1	....	....	1	....	.....
Eyes—full, bright, clear	1	....	....	1	....	.....
Forehead—broad, full	1	....	....	1	....	.....
Ears—medium size, pointed	1	....	....	1	....	.....
Neck—well muscled, crest high	2	....	....	2	....	.....
Fore quarters, 23						
Shoulder—long, oblique	2	....	....	2	....	.....
Arms—short, well muscled	1	....	....	1	....	.....
Forearms—long, wide	2	....	....	2	....	.....
Knees—clean, wide, straight, deep	5	....	....	5	....	.....
Cannons—short, wide	2	....	....	2	....	.....
Fetlocks—wide, straight	2	....	....	2	....	.....
Pasterns—strong, sloping	3	....	....	3	....	.....
Feet—medium, even size, horn dense	6	....	....	6	....	.....
Body, 10						
Withers—well muscled	1	....	....	1	....	.....
Chest—deep, low, large girth	2	....	....	2	....	.....
Ribs—long, well sprung	2	....	....	2	....	.....
Back—straight, short	2	....	....	2	....	.....
Loin—wide, short, thick	2	....	....	2	....	.....
Underline—straight	1	....	....	1	....	.....
Hind quarters, 27						
Hips—smooth, wide apart	2	....	....	2	....	.....
Croup—long, wide, muscular	2	....	....	2	....	.....
Tail—attached high, well carried	1	....	....	1	....	.....
Thighs—long, muscular	2	....	....	2	....	.....
Lower thigh or gaskin—long, wide	2	....	....	2	....	.....
Hocks—clean, wide, straight	5	....	....	5	....	.....
Cannons—short, wide	2	....	....	2	....	.....
Fetlocks—wide, straight	2	....	....	2	....	.....
Pasterns—long, sloping	3	....	....	3	....	.....
Feet—medium, even size, horn dense	6	....	....	6	....	.....
Total	100	....	....	100	....	.....

CATS

The Editors

Although the study of animals for this year includes the cat, we shall not give any lesson on this subject. Most of the necessary information relating to cats is known to teachers and pupils. It would seem that time might be much better spent in giving instruction that relates to other forms of animal life.

It is very essential, however, that the point of view of some of our best students of natural history should be considered in regard to the large number of cats that are allowed freedom throughout the country. At night they wander in all kinds of places, and then go back into the homes in which they are the companions of children. Many persons who make pets of cats feel that there are too many and that the freedom allowed them is serious to the public.

We have asked permission of Professor C. H. Hodge to publish his opinion on this question, and we hope that teachers and parents will give it some consideration. However much any individual may care for a cat, he will doubtless be open-minded enough to help in working out a problem that is of deep interest at the present time. It will be well for teachers to read over the following extract to the older boys and girls and discuss the subject with them. This will give opportunity to consider the question of humane treatment of animal life whenever it is necessary to take measures to prevent animals from becoming a public nuisance. Professor Hodge presents his opinion as follows:

" Unlike dogs, cats readily return to a wild, or semi-wild life, and thus become a menace to much of the valuable and interesting nature life of the country, game birds and animals, and even to poultry. They breed in great numbers in cities, where their lives are, for the most part, a prolonged misery both to themselves and the community. Their cries at night are the most disagreeable sounds we have in nature. The various smells that mark the places they infest are utterly nauseating and intolerable.

" Cats are the worst enemies of our common birds. Mr. Forbush estimates that on the average a cat kills fifty song birds a year, and he has known of a single cat destroying six bird's-nests in a day. In most States the legislature has deemed it wise to pass laws imposing fines upon those who kill birds. It is obviously absurd to fine a man for killing one bird and at the same time allow him to keep a cat that kills fifty. In some cities in Europe, where every effort is being made to protect the birds, cats are considered public nuisances if allowed to run at large. People who wish to have cats must confine them within their own premises, both by day and night, because numerous cat traps are continually set for strays. While not inaugurating a crusade against cats as pets, the lessons in nature study may exert some influence toward inducing children to observe what cats do and possibly to keep other pets so far as possible. Special attention should be directed toward preventing cats from killing birds; abundant feeding, keeping in at night during nesting time, and possibly training, may prove effective in some cases. Bells worn about the neck, as sometimes advocated, may save now and then an old bird, but not the newly hatched nestlings or young birds that are not yet wary or strong enough to fly."

MICE

A. H. WRIGHT

HOUSE mice, *deer mice*, and *field mice* are the three kinds of common mice in this State. Of these the *house mice* are most commonly seen. They were originally natives of southern Asia, but have followed man in all his wanderings and are ever ready to vary their mode of life with the accommodations offered in human dwellings. They make their nests in any secluded spot, varying the material with their habitat. In the barn they use grass and shredded corn leaves; in the house, paper is frequently utilized. The mice raise several litters a year, with five to nine young in a litter. These are very tiny, pink, wrinkled, and almost transparent at birth. In size the adults are about 6.7 inches long; in general color they are gray, slightly tinted with yellowish brown, especially on the face and shoulders, dusky on the back, paler gray below, sometimes suffused with buff. They have long, slender tails bearing a few short hairs. They are nocturnal in their habits, and their fondness for visiting the household larder is well known. Some naturalists think that in winter house mice live largely on flies, spiders, wasps, and other insects hidden away in the crevices of the walls. The voice of the mouse is commonly confined to a small " squeak," but some individuals occasionally possess considerable vocal ability, rendering a faint musical warble.

The *deer mice*, or *white-footed mice*, are very attractive little animals, 6.8 inches in length, with bright, bead-like eyes, large ears, and soft coloring. They are brownish fawn above, brightest on the sides, and darkest on the back where there is a sprinkling of black hairs. They are white below, with the fur lead color at its base. The tail is dusky above, light beneath. The feet are white. The young are lead gray over the whole upper surface, with no brownish or fawn tints, and white below. Their food is largely beechnuts and seeds, but in captivity they are omnivorous. Their habitat is varied, being dense evergreen forests, woods, open fields, or even houses. They are excellent climbers and have their nests in a hole of a tree, log, root, or stump, or they may have a burrow with chambers that are several inches below the surface of the earth. Sometimes they make an outside nest of moss, grass, leaves, and inner bark, or refit birds' nests. There are several litters of young each year, which have been found from April to November.

These mice, when taken young, are easily tamed. They rarely hibernate; when they do it is only in the severest weather. Their tracks, marked with the long tail furrow, are common on the snow. The footprints are arranged like those of the field mouse, in twos; or when they are bounding over the surface, four prints close together are made, two larger ones in front and two smaller ones behind.

The *field mice*, or meadow voles, are 6.5 inches in length, and have thick, compact bodies, short legs, and very short ears. In color they are dark brown above, sprinkled with black, the under parts gray, often washed with buffy. They are abundant in fields and meadows, and feed mainly on grains and on roots of grasses. They make considerable inroads on grain when it is in the shocks, but seldom occur in sufficient numbers to do serious damage. In winter they sometimes injure trees by gnawing the bark, especially when the snow is deep.

Field mice are active either by day or by night, and remain on the ground. They dig simple burrows, barely a foot in length, with a nest of grass at the end; or they may have galleries under a board or a woodpile. They are very prolific, having four to eight young at a time and raising several litters a season. In the spring they nest just below the surface of the ground; later the nest is often found in a little depression on the surface. In winter they live in nests above ground, having runways leading out under the snow. These tunnels have frequent doorways to the surface, but the mice seldom come out in winter. Their small footprints are arranged in twos, the hind feet falling exactly in the prints of the fore feet. They have many natural enemies, as marsh and rough-legged hawks, all the smaller hawks and owls, shrike, skunks, weasels, and the diminutive mole-shrew.

Deer mouse

RABBITS

ANNA BOTSFORD COMSTOCK

In the northeastern United States there is only one common species of rabbit, and that is the gray rabbit, or cottontail. The varying hare, or white rabbit, which was common here fifty years ago, has become practically exterminated. This was one of the most interesting of the species because it changed its coat to white in the winter.

The two most noticeable features in the general appearance of a rabbit are its long ears and its long hind legs. These two characters are closely connected: the long ears are always on the move to catch any sound of danger, and as soon as this is heard its direction is determined; then the long hind legs are used to help the little creature go in the other direction in mighty leaps. The constantly moving nose probably also has to do with sniffing danger, for it is only through sure flight that these little animals may escape from the many enemies that surround them. The rabbits are peculiar also in that the bottoms of their feet are hairy. The front feet cannot be used to hold food to the mouth, as is true of squirrels and mice, but this is not needed, since the rabbit eats on the ground.

The cottontail does not dig a burrow, but sometimes occupies the deserted burrow of a woodchuck or a skunk. Its nest is called a form, which merely means a place beneath a cover of grass or briars, where the grass is beaten down or eaten out for a space large enough for the animal to sit in. The mother makes a soft bed for the young, using grass and her own hair for the purpose; and she constructs a coarse, felted coverlet, under which she tucks her babies with care every time she leaves them. When they are about three weeks old they can run rapidly.

Rabbits have two long, gnawing teeth in the front of each jaw. The remaining teeth are broad grinders in the back of the mouth. All rodents except the rabbit have no teeth between the gnawing teeth and the grinding teeth, but rabbits have a small pair of teeth arranged one on each side of the upper long ones. These are left-overs from rabbit ancestors which evidently had four gnawing teeth on each jaw. It is with the front gnawing teeth that the rabbit hurts young trees by girdling them in winter when driven by starvation to feed on the bark. The cleft in the upper lip leaves the gnawing teeth free.

The varieties of rabbits and hares found under domestication are: *Belgian hare*, fawn to red-brown in color, medium size, long and graceful; bred for the market. *Common rabbit*, which may be white (albino), black, maltese, or with broken colors. *Angora*, white or broken-colored; a small to medium breed, with short ears and silky hair; a purely fancy breed. *Lop-eared*, fawn to brown in color; very large ears, which droop; this is a fancy breed, very tender, requiring artificial heat in winter. *Himalayan*, a small medium breed; white, with black ears, nose, and feet; short hair; alert and active; a very fancy breed. *Flemish Giant*, very large, weighing fourteen to eighteen pounds; fawn to brown in color; seldom raised.

SQUIRRELS

A. H. WRIGHT

We have several kinds of squirrels in this State, which differ widely in their appearance and habits — red, gray, fox, and flying squirrels, chipmunks, and woodchucks.

The *red squirrels*, or chickarees, are well-known little " chatterboxes," found in all our woods even among the densest evergreens. Their size is small — they are twelve and one half inches in length; their backs are red, varying in shade, and the under parts are white or gray. They are the proud possessors of bushy tails. They are queer bundles of characteristics — inquisitive, audacious, insolent, and mischief-loving, but intelligent, persevering, industrious, and clever, with an irresistible sense of humor. Chattering and busy throughout the day, they cut off pine cones before they are ripe and chestnuts while still in the bur. They store mushrooms in the forks of trees, awaiting the time of need. Their food is varied — nuts, acorns, seeds and roots, buds and leaf stems of certain trees, several species of toadstools, and other fungi, seeds from cones of pines and spruces, fruits and berries, beetles, birds' eggs, and even young birds. Scraps of meat or fish prove very acceptable whenever available. The red squirrels are expert climbers and good swimmers, and make good time in covering the ground. They travel by bounds, and leave footprints that consist of three or four impressions, the hind feet falling just ahead of and outside the fore feet. Unlike the track of the rabbit, the toe marks are distinct. These squirrels do not hibernate, but retire to their nests for the worst storms. They may be located in a hollow limb, a hollow in the ground, or a hollow log; or sometimes they build outside nests of twigs and bark, which are great, ball-like structures, sixteen inches across with a chamber of six inches. These they often place high up in evergreen trees. The four to six young are born about the first of April.

The *gray squirrels* are larger than the red, nineteen and three quarters inches in length. Their backs are a clear silvery gray in winter, tinged with yellowish in summer; the under parts are white, occasionally blotched with rusty; the ears are whitish. A black phase of this animal is rather common, both colors being found in one litter. Occasionally white forms are recorded, as is true also of the red squirrel. The gray squirrels are not fond of evergreen forests, as their smaller brother is, but prefer the hardwood groves, especially the beeches which supply them both nuts and favorable sites for their outside nests. These watertight apartments are built wherever the weather is not too severe, and whenever a convenient woodpecker's hole or a hollow tree or limb is not found. From below, these structures look like crows' nests, as they are built on platforms of twigs. They are so well covered that they shed the rain. Leaves are used to a considerable extent in the construction of all the nests. Nuts are the principal food of these squirrels, and they begin to eat these long before they are ripe; and they store large quantities for winter and spring. They do not gather these together in one place, but prefer to hide a few in one spot. To find them again, they must be largely dependent on their acute sense of smell. They have a saucy cry of *qua-qua-qua—qua-a-a*. These alert little squirrels usually escape capture by clinging to the side of the branch or trunk of the tree opposite the enemy, whether hawk or boy; but in captivity they are easily tamed and make very intelligent pets.

Gray squirrel

The largest of our squirrels are the *fox squirrels*, which are twenty-three inches long. They are very scarce in this State except in the lower part. Their backs are always tinged with rusty; the under parts are never pure white, varying from bright rusty to rusty white; and the ears are rusty. Black and semi-black individuals occur also among these animals.

The little *flying squirrels*, only nine inches long, are quite unlike our other squirrels. They have what none of the others have — broad, furry membranes connecting their front and hind legs. With their beautiful bright eyes, their drab backs somewhat shaded with russet, and their white under parts, they are as dainty animals as one could wish to see. They live on nuts, seeds, and buds, and also on beetles and perhaps other insects. Occasionally they eat flesh. Their nests are in hollow trees, frequently in deserted woodpeckers' holes. Here several of them often live together, and they may be aroused easily and driven out by hammering on the tree trunk. In accordance with their nocturnal habits they come out just at nightfall, climb to the top of a tree, and sail to the foot of another tree perhaps fifty yards away. Then, climbing this tree, they glide to another. They live in seclusion during the severest weather, but it is not known that they regularly hibernate. The young, numbering three to six, are born early in April.

The *chipmunks* are ten inches in length and reddish or yellowish brown in color, with five black and two whitish stripes down their backs. They are very fond of nuts, preferring beechnuts; but they will eat roots, corn, and other grain, and the larvæ of certain insects. They put away large stores in their burrows, for they stay in winter quarters from the middle of November until March or April. Sometimes they come out and look around on a bright winter day. From one nest occupied by four chipmunks there was once taken a quart of beaked hazelnuts, a peck of acorns, some Indian corn, two quarts of buckwheat, and a very small quantity of grass seeds. All this they had industriously gathered and carried to their storehouse in the large pouches of their cheeks. They often have temporary "caches" carefully hidden among the leaves for one of their "cheek-loads." The chipmunks are diurnal in habit and stay on the ground most of the time, except when some venturesome sprite goes after seeds in a tree. When surprised by a passer-by, they utter a sharp *chip-per-r-r-r* and dash for a retreat, preferring a loose brush heap, a rail fence, or a similar structure, where they can watch readily and change their position frequently. Their homes are long, crooked tunnels in a bank, with entrances in a thicket. The burrows are one and one half or two inches in diameter, and have a network of branches. The nests are deep in the ground. The four or five young leave the nest by June and are full-grown by August.

Flying squirrels

PLANT STUDY

THE EDITORS

IN rural districts, economic, ornamental, and wild plants are always available for study; and without taking a large amount of time the teacher can direct the observation of the boys and girls in such a way that they will gradually develop an interest in all growing things. This is an important part of education, whether young persons stay on the farm or leave it. If they become farmers, their possibilities of success will be increased if they have an intelligent interest in plant life. Observation of soil in which a plant grows, its habit of growth, its method of producing seed, and the like, provide material for fundamental study. The blossoms of clover, corn, pea, tomato, wheat, and other plants, are full of interest, and a child must begin young in order to have quick, ready observation of the common things. A few lessons at school will be of value.

The study of wild plants has an interest for boys and girls, particularly in the springtime. Many teachers are gradually gathering wild plants for a permanent contribution to the school garden. The children may be taught to mark some of the most thrifty wild plants in the spring, so that they can recognize them in the fall, at which season they may be more successfully transplanted. This will give opportunity for valuable instruction. Conditions of soil, moisture, and the like should be studied with care, so that in the garden the environment will be similar to that from which the plants were taken. There are schools in New York State in which this kind of teaching is being done.

A simple herbarium prepared at school often awakens a more active interest in plant life. Some excellent specimen sheets have been sent to us from rural schools in which there was no better equipment for the work than old newspapers, two boards, heavy stones for weights, and plain white drawing paper for mounts. In order to make good herbarium specimens, plants should be dried as quickly as possible; and therefore the papers should be frequently changed, the oftener the better. The wild plants, grains, grasses, weeds, and other forms make interesting material for the herbarium.

Children should be taught to protect the wild plants in the neighborhood, and to avoid uprooting them when gathering spring blossoms.

Rare plants should be left to increase through the years. In many sections of New York State, arbutus, orchids, and other desirable plants have practically disappeared because of careless and unnecessary uprooting. Tell the boys and girls that the persons who love flowers best and get the most pleasure from them do not need to gather them. When plants are plentiful or when we wish them for purposes of study, collecting them is justifiable; but if we see a single orchid in the wood or a few cardinal flowers near the brookside, they should be left to give others the joy that they have given us. There is much mutilation of plants along the waysides which shows a lack of training. The writers have been watching the destructive habits of persons who pass a certain hedge of trees and shrubbery. Again and again adults, as well as children, will break off branches and blossoms as they pass.

There is no better way, perhaps, to encourage the children to study plant life than by preparing an exhibition of herbarium specimens either for the school, for the county fair, for Farmers' Week at Cornell University, or for the educational exhibit at the New York State Fair. Do not have in mind the splendid exhibits of plants that you have seen prepared at universities and places where there is excellent equipment, because the exhibits prepared by children will never be judged without taking into consideration the materials with which the young persons were obliged to work. First of all we value the effort of the children, and would prefer that teachers and parents do as little as possible toward the preparation of the specimens. It is well to teach the boys and girls the value of neat and orderly arrangement of anything for exhibition, but let us always realize that their little hands cannot produce the ideal.

A trip afield

LEGUMES

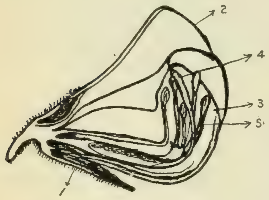
G. F. WARREN

RECOGNITION OF LEGUMES

The group of plants that is most important to mankind is the great grass family (*Gramineæ*), which includes corn, wheat, oats, rye, barley, timothy, and others. One will readily see that all these are much alike, particularly in the leaves and leaf arrangement.

The second group in importance is the pea family (*Leguminoseæ*). Plants in this group are commonly called legumes. Articles on the following pages of this leaflet tell why these plants are so valuable to us. The first thing is to learn to recognize them.

Probably the best way to study the lesson outlined below is to take the class to the field and find and compare all the legumes possible—clovers of various kinds, alfalfa, sweet clover, peas, sweet peas, beans, vetches, black locust, and all plants with pea-like flowers. Or the work may be given in the schoolroom. The first day might then be devoted to a study of either a bean, a pea, or a clover blossom, and to making drawings of it. After this, each pupil is to bring in as many similar plants as possible. One or more lessons can then be given in comparing them. At the same time learn the common names.



Pea flower cut in two

1, Sepal; 2, standard, or banner (one of the petals); 3, keel (part of the corolla); 4, style; 5, stamens

The following outline for the study is suggested:

How are the leaves arranged?

Are the leaves simple (all in one piece) or compound (divided into several leaflets)?

What two kinds of compound leaves are shown? Draw one of each kind, as pea and clover.

If the class has not learned to recognize the parts of the flower (sepals, petals, stamens, pistil), these should be learned.

Examine the corolla and note the shape of its parts. Make a drawing of the blossom.

How many stamens? How are they arranged? Draw them.

Split a pea or bean pod. How does it open?

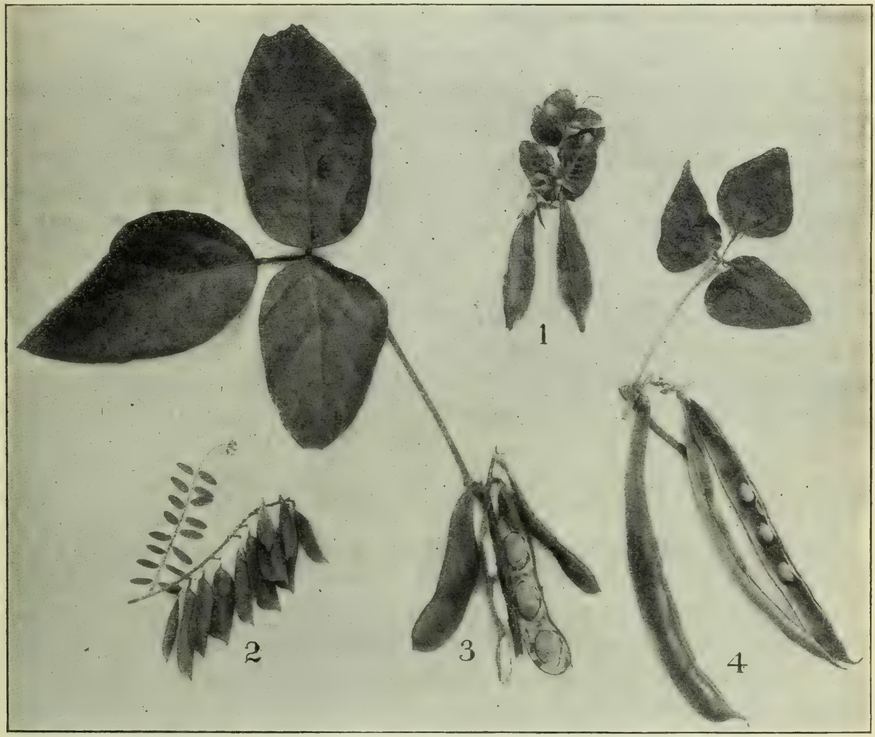
Make a list of all the legumes that you find growing in the neighborhood and another list of all that are planted by farmers.

The following points will be discovered:

1. The leaves are always alternate, that is, no two leaves are at the same level.

2. The leaves are compound (there are a few exceptions). The leaflets are arranged along a midrib, as in the pea, vetch, peanut, and locust; or they may be palmately compound with the leaflets coming out like the fingers from the palm, as in clover and alfalfa.

3. Many of the legumes can be recognized by the shape of the blossom. They are sometimes named the *Papilionaceæ* family of plants, the word meaning butterfly-like. Pea blossoms have this butterfly-like appearance. The stamens are often surrounded by a more or less boat-shaped part of the corolla. This part is called the keel because of its similarity to a boat. Many of the legumes can be told by this boat-shaped appearance. When examining clover, remember that the head is made of many separate blossoms.



Pods of leguminous plants

1, Pea; 2, hairy vetch; 3, soy bean; 4, bean. The opened pods show the characteristics from which these plants derive the name "legume"

4. There are usually ten stamens, none of which are united around the pistil and one of which is commonly independent.

5. The pods split along both sides into two parts. The name "legume" refers to this characteristic. The word is used to denote a simple dry

seed-pod that splits along both sides, with the seeds on one edge of it. This characteristic is more difficult to distinguish in very small seed pods, as those of clover. The word "legume" is now commonly used, however, to mean a plant that bears a legume.

If you find any legume whose common name you do not know, send a specimen with blossoms and seed pods, and we will identify it.

Words to be spelled and defined

Legume or *leguminous plant*, a member of the pea or clover family.
Compound leaf, a leaf that is divided into distinct blades or leaflets, as a clover leaf.
Simple leaf, a leaf that is all in one piece, as a maple leaf.
Calyx, the outer part of the flower, usually green.
Sepal, one division of the calyx.
Corolla, the inner circle of flower leaves, usually not green.
Petal, one division of the corolla
Pistil, the central organ of the flower, in the base of which the seeds develop.
Stamen, the organ of a flower that bears the pollen.
Alfalfa, a clover-like perennial legume.

STUDY OF THE ROOTS OF LEGUMES

When the boys and girls have learned to recognize legumes it will be well to have them make a study of the nodules on the roots of these plants.

1. Take the class to the school yard or to a field and dig up as many kinds of legumes as possible. This work can be given at any time until the ground freezes too hard for digging. Almost any roadside will furnish an assortment of legumes.

Examine as many of the following as possible: red clover, white clover, sweet clover, beans, peas, alfalfa.

Examine the roots of clover for small white nodules or tubercles about twice the size of a pinhead. Those on other clovers and on alfalfa are also small. Those on beans are about half as large as a pea seed.

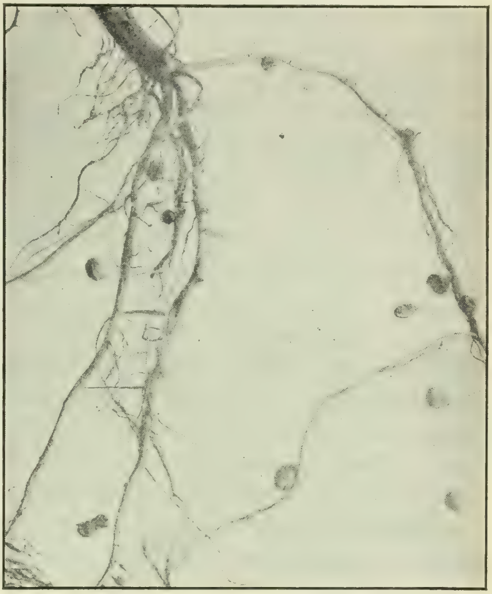
What is the shape of the nodules on each kind of plant?

Make a drawing of the roots of several plants showing different kinds of nodules.

Dig up some grasses and other kinds of plants and try to find nodules.

The teacher should explain the nature and value of the nodules. (See page 1387.)

2. Ask the students to bring to school as many other kinds of legume roots as they can find, so that the other members of the school can see them.



Nodules on the roots of a bean

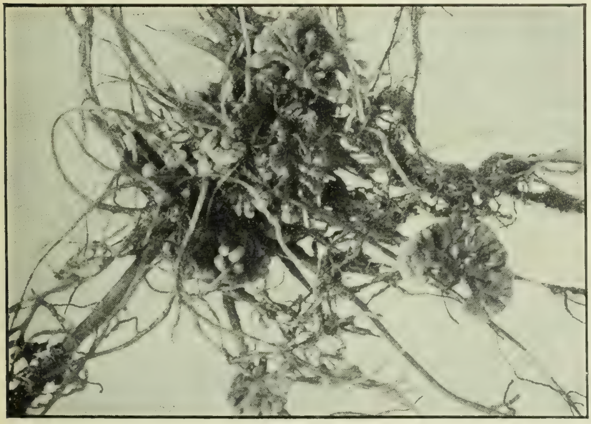
It is possible to give the entire lesson with materials brought in by students, but it is better to begin with a field trip.

Are alfalfa or soy beans grown in the neighborhood?

If so, has the soil been inoculated with soil from an old field? Why was this done?

3. The best specimens found may be preserved in the schoolroom. They will arouse interest on the part of patrons who visit the school.

In order to preserve them, place the roots in a wide-mouth bottle or a fruit jar, and fill with ninety-six parts of water and four parts of formalin. Then seal tightly. If well sealed, the roots should keep permanently. Do not forget to label them. A few ounces of formalin may be procured at a drug store. Other materials may be preserved in the same way.



Nodules on the roots of hairy vetch. Compare their size and shape with those of clover and bean

4. Bacteria are microscopic plants. There are many kinds of them. One kind causes typhoid fever and another causes tuberculosis. But the great majority are either harmless or helpful to mankind.

Certain kinds of bacteria in the soil are good friends to the farmer.

One kind lives on the roots of legumes and causes the nodules, or tubercles. In some way these bacteria take nitrogen from the air so that it becomes available for the growth of plants. The larger part of the air is nitrogen, but none of the higher plants can take nitrogen from the air. They can only use it when it is combined with other things. The air between the particles of the soil furnishes the nitrogen for the bacteria on the legumes. These bacteria do not live on the roots of any common plants except legumes.

The reason why this is so important a subject is because nitrogen is the most expensive thing that farmers buy in fertilizers. They now pay about twenty cents a pound for the amount of actual nitrogen in a fertilizer.

Sometimes the bacteria are not in the soil, so that the legumes do not have the tubercles. Only when a new kind of legume is introduced are the bacteria likely to be lacking. The majority of the soils in New York State need to be inoculated for alfalfa when it is first grown, and so far as we know all soils in the State need to be inoculated for soy beans. The best means of inoculation is to take soil from a field where the crop is inoculated and scatter on the new land. About two hundred pounds of such soil is enough for an acre. Sweet-clover soil inoculates alfalfa; so that where sweet clover is plentiful, alfalfa does not often need to be inoculated.

Words to be spelled and defined

Nodule, a little knot or lump.

Tubercle, a nodule formed within a plant or an animal by bacteria.

Bacteria, microscopic plants often called microbes.

Microscopic, too small to be seen without a microscope.

Nitrogen, a gas that constitutes about four fifths of the air.

Fertilizer, a material for making land more productive.

Inoculation, infection with bacteria or some other organism; as inoculation with smallpox virus, or the adding of certain bacteria to a soil.

LEGUMES AS FOOD

We have already learned that nitrogen is one of the very important plant-foods, and that leguminous plants are able to obtain a part of their nitrogen from the air, provided the proper bacteria are present for the formation of the nodules on the roots.

All plants can take nitrogen from the compounds in the soil. Legumes are no exception. They have two ways of obtaining nitrogen, hence we shall not be surprised to learn that they contain a higher percentage of it than do other plants. A very common error is to suppose that because legumes can obtain some nitrogen from the air, they do not need much of it in the soil or the fertilizer. Nearly all legumes require a rich soil for their successful growth. They have two ways of getting nitrogen, and can live by either way alone but need both ways in order to produce good crops.

The following table shows the percentage of nitrogen and protein in a few crops. The first two are legumes.

TABLE 1

	Nitrogen (per cent)	Protein (per cent)
Alfalfa hay	2.29	14.3
Clover hay	1.96	12.3
Corn fodder with ears	0.72	4.5
Timothy hay	0.94	5.9

Nitrogen does not occur in plants as an element, but as a compound. The compounds that contain nitrogen are commonly called protein; "nitrogenous compounds" would be a more accurate name. There are a number of these compounds. On the average they contain about 16 per cent of nitrogen. When a chemist determines the percentage of protein he finds the amount of nitrogen and multiplies this by six and one fourth in order to get the percentage of protein. One of the very important constituents of our food is protein. The following table gives the amount of water and protein in a few foods:

TABLE 2

	Water (per cent)	Protein (per cent)
Green peas	81.8	3.4
Dried peas	9.5	24.6
Dried beans	12.6	22.5
Peanuts	9.2	25.8
Wheat flour	12.1	11.2
Lean beef	70.0	21.3
Milk	87.0	3.3
Eggs	73.7	14.8
Potatoes	78.3	2.2

It will be seen that these legumes contain over twice as much protein as wheat flour. Peas and beans may be used to replace the protein of meat to a considerable extent. They are a little harder to digest, and therefore are not ordinarily used in very large quantities except by persons who have outdoor work.

The most important way in which legumes furnish protein for human food is indirectly. Of course an animal that produces lean meat, eggs, milk, or other product that is high in protein, must have much protein in its food. Alfalfa and clover hay are the indirect source of much of the protein in our milk and meat.

Problem 1. What percentage of nitrogen is there in each of the foods in Table 2?

Problem 2. Another way to compare these is on the basis of dry matter. Green peas contain 81.8 per cent of water and 3.4 per cent of protein, or 18.2 per cent of dry matter of which 18.7 per cent is protein. How much dry matter is there in each of the other foods? What percentage of the dry matter is protein?

Protein is only one of several important constituents of food.

SWEET PEAS AND GARDEN PEAS

THE EDITORS

The relationships of plants are always interesting to children. In studying the pea, have the boys and girls gather some material from which they may be able to trace the likenesses of peas to locust, clover, alfalfa, beans, lupine, or other plants in the family.

If there is interest in these plants have a lesson on the blossom of the pea, calling attention to the parts (see figure on page 1384). The pupils can easily distinguish the upper petal, called the banner, or standard; the two side petals, called the wings; and the two lower ones, grown together and called the heel. They will see the ten stamens, nine united and one free, and the single pistil.

The compound leaves are interesting, and the tendrils which reach out for support for the plant. Observations may be made on the pods, and the way in which sweet peas send out the seeds.

In rural districts there are many lovers of flowers who grow sweet peas successfully. A visit to a good garden to see the many different-colored sweet peas, and to learn how they were grown, will be of interest to the children. If gypsophila is also grown in the same garden, the teacher will have an opportunity to show what a beautiful combination of cut flowers may be made with sweet peas and gypsophila.

It will be well to make a study of garden peas grown in the neighborhood. What varieties are most popular? What succession is advisable in order to extend the season of peas for the home table? Why not have a small crop of peas grown at school this year, even if it has to be harvested in vacation? Many rural teachers have found that it is not difficult to encourage some pupil or pupils to complete the work of a simple school garden, and the cultivation of a small crop at school often leads to greater interest in the larger crop at home.

RYE

E. G. Montgomery

Rye is more like wheat than any other cereal. The plant is similar, but the head is more slender. It differs principally in being hardier, and not only will grow in colder countries than wheat, but also does well on poorer soils. Rye flour makes good bread, but the bread is darker in color and more moist than wheat bread. In America we eat wheat bread principally, but in certain countries, as Germany and Russia, more rye bread is eaten than wheat bread. In Germany three times as much rye is raised as wheat. In New York State rye is raised in a small way for various purposes. It is usually sown in the fall, at any time from August to October. It makes a full growth, and is well rooted so that it is ready to make a very rapid growth in the following spring. It grows faster and ripens earlier than any other grain, usually being ready to harvest about the first of July.

Rye

Because of its rapid early growth, farmers often grow rye for green manure. That is, it is sown in the fall after a crop of grain has been harvested, and makes a heavy growth which is plowed under the next spring in time to plant potatoes or corn.

Rye is also grown for the straw, especially in the vicinity of large cities such as New York. The straw is valuable for bedding in barns, also for wrapping and packing merchandise such as glassware or furniture. Coarse matting is also made from the straw, and in some places the straw is used for making hats or mats.

Observations.— What color is young rye when it first comes up? Measure the length of a dozen rye heads and a dozen wheat heads, and figure out the average lengths. How many rows of grain are there on a rye head? on a wheat head? Dry some rye straw, wheat straw, and oat straw. Which is toughest? Which is strongest?

ORCHARD GRASS

E. G. MONTGOMERY

The name " cocksfoot " is applied to orchard grass in England because of the supposed resemblance of the seed head to a cock's foot. In America the name "orchard grass" is used, probably because of its well-known habit of growing well in partial shade, such as that afforded by open woods or orchard. It is found growing wild throughout New York State, especially on grassy land that has not been grazed nor mowed, such as a roadside or a protected park.

Orchard grass is tall and coarse, two to four feet in height, and is usually found growing in bunches or tussocks. It is called bunch grass in comparison with other grasses — as blue grass, which is called sod grass. A well-developed plant will measure six inches in diameter at the base, but the graceful, spreading stems will form a plant two feet across near the top and four feet high. Orchard grass is adapted to a greater variety of conditions than are most common grasses. Not only does it grow well on wet lands subject to overflow, where timothy, for example, would be eradicated, but also it will grow on dry hills and endure hotter summer weather than will timothy. It is not so good a hay grass as timothy; therefore it is grown for hay where timothy does not do well, especially farther south, as in Virginia and Kentucky. It makes a rather coarse hay, unless cut at the right stage.

As a pasture plant in New York State, orchard grass has great merit, coming very early in the spring and making a good growth late in the fall. For best results as pasture it should be combined with some sod grass, such as blue grass, redtop, or even timothy.

Observations.— Find a good plant of orchard grass, and note when it makes first spring growth as compared with blue grass and timothy. Note the date when it is twelve inches high, and the same for timothy. When does it head? blossom? Are the leaves folded or rolled when they first appear? Compare this with other common grasses as to these points. Can you find it growing in complete shade?

SWEET CLOVER

E. G. MONTGOMERY

The Latin name of sweet clover is *Melilotus*, which comes from the Greek words meaning honey lotus. It has a very sweet smell, and has long been recognized as a plant sought by honeybees. Beekeepers often sow sweet clover in waste places for their bees.

There are three kinds of sweet clover, known as large white, large yellow, and small yellow. The large white and large yellow are both found distributed wild throughout New York State, although the white is more common and is considered the more useful of the two. The small yellow is not found in this State, but is very abundant on the Pacific Coast.

Sweet clovers are found growing wild in waste places, especially where the soils contain limestone. They are frequently observed to be the first plant to grow in the sides of new road cuts. Occasionally a farmer sows white sweet clover for pasture or forage, but this is not common, since its culture is not so easy as that of red clover or timothy, and stock do not always eat it readily.

Sweet clover is a biennial; that is, it does not form seed in the same year that it is sown. In the first year the plants grow one to two feet high but do not blossom. In the second year they start very early in the spring, make a strong, vigorous growth five to eight feet high, produce a great mass of blossoms in midsummer, and continue to blossom for several weeks — a quality that makes the plant valuable for bee pasture. Seeds falling to the ground produce new plants in the same fall, which blossom the next year. One peculiar thing is that only a part of the seeds germinate the first year, the remainder lying in the soil for one to two years before growing. This provision of nature helps to keep the clover from being exterminated, in case something should happen to destroy the living plants. The sweet odor is due to the presence of coumarin in the leaves.

Observations.— Where do you find sweet clover growing in your neighborhood? Is it white- or yellow-flowered? If you have both kinds, what difference do you observe in size and branching of the plants? How long will a given sweet-clover patch be in blossom? Observe new excavations, such as rock quarries, sand pits, or new road cuts, in order to see whether sweet clover is one of the first plants appearing. Look at the blossom very closely. In what way does it resemble the sweet pea? Can you find the banner petal, the wings, the keel? (See page 1384.) If you have a hand lens, note the stamens and the pistil.

PLANTS TO BE RECOGNIZED IN 1914-1915

THE EDITORS

In teaching children the names of the common plants given for study this year, many interesting facts may be associated with both the wild and cultivated forms. The kinships always have interest, and the older pupils can be taught to learn something of the relations of the plants observed to other plants. A copy of *Gray's New Manual of Botany* (seventh editon) should be in every school to be used for reference by the teacher. *The Fieldbook of American Wild Flowers*, by F. Schuyler Mathews, is a handy book of reference and one that children can use. The following are a few suggestions that will be helpful:

Geraniums.— These plants are interesting in both wild and cultivated forms. They belong to the geranium family, to which belong also the common wild cranesbill, herb robert, and other plants. The word "geranium" means crane's bill, and was suggested by the appearance of the seed pods, which resemble the bird's bill. Note color, shape, and parts of flower; shape of the leaves; whether the stems are slender or fleshy, hairy or smooth.

The cultivated geranium should be found in every rural school, at least in fall and spring. The children may be taught to propagate it by cuttings. The way to do this is so well known that we need not give directions here.

Hepatica.— The hepatica is a member of the crowfoot family, to which belong also buttercup, meadow rue, anemone, virgin's bower, marsh marigold, columbine, larkspur, and others. It is often called liverwort because of the leaves, which are somewhat liver-shaped. The pupils should notice where hepaticas grow, whether the plants are smooth or hairy, the shape of the leaves, the size and color of the blossoms, and whether different plants have differences in leaves and flowers. What kind of seeds are borne by hepaticas? A plant or two should be transplanted to the school garden in autumn.

Strawberry.— The common wild strawberry is known to all country children, and a lesson or two in the field will give them new interest in it and will furnish one more opportunity to encourage observation of plants.

The kinship of the strawberry and the rose should enter into the lesson. The older boys and girls might care to know that the generic Latin name of the common wild form of strawberry, *Fragaria*, means fragrant. Attention should be called to the broad, coarsely-toothed leaflets; the hairy flower stalk; the five white petals. The fruit is well known, and, if it is ripe when the lesson is given, will be regarded with enthusiasm. What kind of fruit has the wild rose? How does the cultivated strawberry plant differ from the wild form?

Some boys and girls might be interested in a community strawberry bed for a school festival or community picnic. This might be one way to encourage the growing of strawberries. Of course there would be no results in the first year, but a valuable part of all education is to be patient in securing results worth while. Should the pupils want help in starting a strawberry bed, the following directions given by H. B. Knapp will help. First, however, teach the boys and girls to obtain all the local information possible. The best way to reach success in this enterprise will be to follow the instructions of a successful grower in the neighborhood.

Instructions for growing strawberries.— Strawberries require a loose, rather light, warm soil. The soil should also be rich and moist. The plants should usually be set in the spring. Spring-set plants will produce a good crop in the following summer. Strawberry plants may be obtained either from old patches or direct from nurserymen. They may be obtained in lots of one hundred for sixty to seventy-five cents. There are any number of varieties that are satisfactory, but it is often the case that a single variety of strawberry, when grown alone, will not set fruit. This is because the blossoms are self-sterile, as we say; that is, the pollen from the flowers of a variety will not fertilize the flowers of the same variety. Some varieties also have blossoms that lack the stamens. For these reasons it is necessary to have plants that produce flowers with both stamens and pistils set in the same patch with those that are lacking stamens or are not self-fertile. In most catalogues the plants that produce flowers with only pistils are marked with the letter "P," and those having both stamens and pistils are marked with the letter "S." In some cases the letter "P" is used to designate the perfect flower, that is, the flower having both stamens and pistils; therefore it is well to examine the catalogue when plants are bought, in order to be sure of the meaning with which the letter is used.

The plants should be set early in the spring on land in good tilth, which has been occupied by a cultivated crop during the previous year. In no case should strawberries be set on sod ground, for the white grub, which is one of the most serious enemies of this fruit, flourishes in sod. The plants should be set in rows three and one half to four feet apart, and about eighteen inches apart in the row.

Clean and thorough cultivation should be given during the entire summer, the purpose being to obtain a large amount of vegetative growth in the first year. If blossoms appear and fruit is set, the fruit should be pinched off. The amount of fruit that would be borne in any case would be slight, and the vitality that would be used in developing the fruit might better go into the plant itself. It is highly important that the patch be kept clean and free from weeds; during the first year frequent hoeings will probably be necessary. As the plants grow they will put forth runners, on which sets, or young plants, will be formed. These runners should be placed by hand in such a position that they fill up any vacant spaces, thus increasing the width of the row until it is twelve to eighteen inches across. It may be necessary to remove completely some of these runners, or stolons.

A strawberry plant ready for the field

In most cases a little winter protection is desirable. This is very important when the patch is situated in an exposed place, where the snow does not remain long enough to form a permanent covering. A mulch of coarse straw may well be applied, just before winter sets in, in order to protect the plants from the severe cold and also to prevent alternate freezing and thawing. There is considerably more danger of applying this mulch too thickly than too thinly, because it is very easy to smother the plants. A mulch two or three inches in thickness is entirely sufficient and some coarse material is best. This mulch should be removed early in the succeeding spring and allowed to remain between the rows. If the bed is not mulched, cultivation should be begun early in the spring before the blossoms appear. Strawberry beds should never be worked during blossoming time, as there is great danger of blasting the flowers; and unless there is a layer of straw or some other material between the fruit and the soil, the berries very often become covered with dirt during heavy rains.

Strawberry patches are usually not allowed to bear for more than one year, because the growers find it easier and more profitable to set a new patch than to attempt to keep the old one clean after the first year.

Apples.— The importance of the apple leads us to give it some special study on every possible occasion. The pupils will be interested in its relation to the rose, the strawberry, and other plants known to them; and throughout the year there will be opportunity to make interesting studies of the trees, the blossoms, and the fruits. For some suggestive work in connection with this topic we would call attention to pages 1470 and 1471.

Goldenrod.— The goldenrod belongs to the composite family, which includes the dandelion, ragweed, aster, daisy, and many other plants. Children will enjoy tracing some of the likenesses to be found in these plants of near kin.

Goldenrod is valuable in teaching boys and girls close observation. The teacher might bring one species of goldenrod to school, and from the study of this start the children on a quest to find other species. The little wood form is very different from the Canada goldenrod. In many parts of New York State a large number of species can be found.

Bluets

The attention of the pupils should be called to anything that might lead to observation of goldenrod. They should note whether the plant grows in the woods or in the open; its height; whether the stem is rough or smooth, angular or round; whether the flower heads are terminal or arranged along the stalk in the axils of the leaf.

Columbine

Bluets. — The bluet belongs to the madder family, and is therefore related to the partridge berry, bedstraw, and many other plants. It may interest the children to know that coffee belongs to this family. Bluets are called "Quaker ladies," and sometimes "innocence." They are found in moist, grassy places, frequently in pastures. They are small herbs, usually tufted. The leaves are small, and the blossoms, which are pale lilac, bluish violet, or white with yellow center, measure about one half inch in diameter.

Columbine. — The columbine belongs to the same family as does the buttercup. It is attractive in both wild and cultivated forms. The wild columbines may be found in rocky gorges, on hillsides, and in glens. The boys and girls will be able to make good observations on the long-stemmed, compound leaves, with three-lobed leaflets; the petals, which end in the spurs; the sepals between the tube-like petals; the yellow stamens.

Lettuce.— The best way to interest children in good observation of lettuce is to have them grow it at home or at school. If possible have them learn the difference in the taste of lettuce that is tough and bitter, and that which is crisp and tender. As a salad food lettuce is so valuable that we should teach an appreciation of it. Boston head lettuce is a very interesting plant. If the teacher can procure a head for a lesson, and then teach the children to use it in making sandwiches, a good time and some worth-while knowledge will result.

In connection with the study of lettuce, the following points might be considered by way of adding interest:

Lettuce belongs to the composite family and is related to the dandelion, which the pupils will note has a similar milky juice. There are two important types, the head lettuce and the loose lettuce. In cultivating lettuce it should be remembered that the plant thrives in cool weather, and therefore grows best in late spring or early fall. It needs a rich, well-prepared loam soil. It may be started under glass and transplanted. The rows should be one foot apart, and the plants eight to ten inches apart. In order to produce large, tender heads, there should be quick growth.

Onion.— It is always of interest to young persons to know that the onion belongs to the lily family, and that the bulb, which in the onion we use for food, is characteristic of this family.

Onions give opportunity for some interesting observation; and, since they are grown on the farms, it will be well to call the attention of the boys and girls to some facts connected with them.

The onion probably came from southwestern Asia, and has been used for food since the time of the ancient Egyptians.

Onions require a rich loam or muck soil and should be kept well weeded. They are propagated by seeds, bulblets, multipliers, and sets. Have the pupils ever seen the bulblets, or small bulbs, that are produced in clusters at the end of the seed stalk of some varieties of onions? These will grow if set out in the spring, and may be used at any time.

Bloodroot.— A well-known plant belonging to the poppy family, and therefore related to the celandine. It has orange-red juice, which was used by the Indians for war paint.

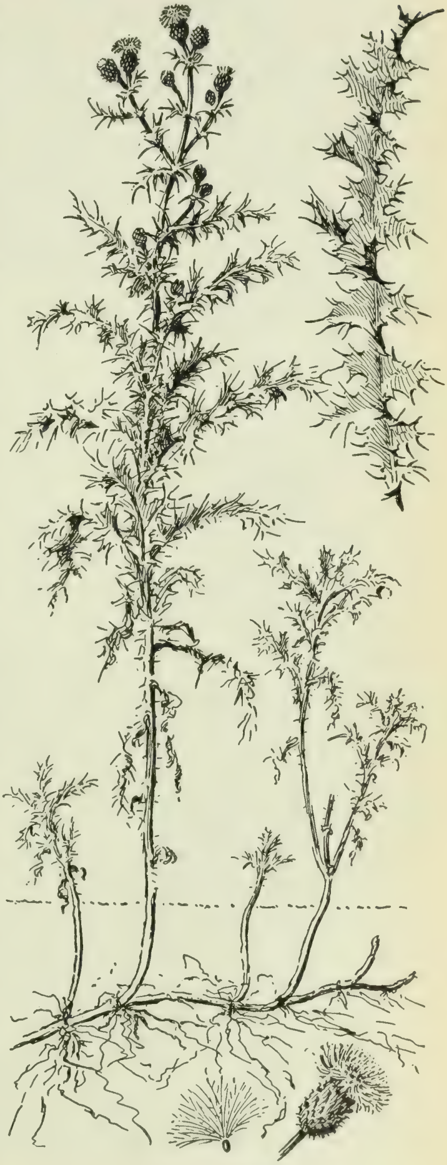
The pupils should observe the way in which the leaf encloses the budding blossom until it grows above it; the eight, or occasionally twelve, white petals; the two sepals, which fall when the flower opens; the stamens, of which there are about twenty-four; the short style and the two-grooved stigma.

WEEDS FOR STUDY IN 1914–1915

Paul J. White

Editors' Note.— Weeds are interesting plants and are always available for lessons in the schoolroom. The best place to study them is in the out-of-doors, and in autumn the children are able to have a good demonstration of what weeds will accomplish if left alone. If the boys and girls in the community will take as much interest in the destruction of weeds this year as they did last year in the destruction of the tent caterpillar, we shall feel that fine work is being done. If any such enterprise is undertaken, we want to hear about it, and we therefore hope that teachers and pupils will keep records of efforts to destroy weeds during 1914–1915. Some years ago a group of children in one family practically eradicated wild carrot on a large farm.

In giving instruction on the weeds for study this year, teachers will find the following information valuable:



Canada thistle

Canada thistle. — This weed is very common, especially in pastures. It occurs also in plowed land. It may be distinguished from other thistles by the root. If a plant is dug up it will be found to have heavy roots, called rootstocks, which extend some distance from the plant, parallel with the surface of the ground. These may be six to ten inches below the surface. Every three or four inches new plants grow up from these. One seed may in time produce a large patch of these weeds from the roots alone.

The Canada thistle spreads into new fields by means of seeds. These seeds may be sown with clovers, grasses, or even oats. Moreover, the seed has at the top a feathery attachment which permits it to sail away in the wind like a balloon to a new home where it will not be crowded by other seeds.

This weed lives for many years and spreads every year unless destroyed. Merely plowing the land once will not kill it. That is the reason why it is so common in oat fields. A cultivated crop that is carefully tilled helps to destroy it. It can be destroyed in pastures by mowing twice a year, in June and in August. It should not be allowed to blossom. If the plants are not too numerous they may be cut off below the surface of the ground and a spoonful of salt put on the fresh cut. If persisted in as often as the weeds appear, this method is usually effective.

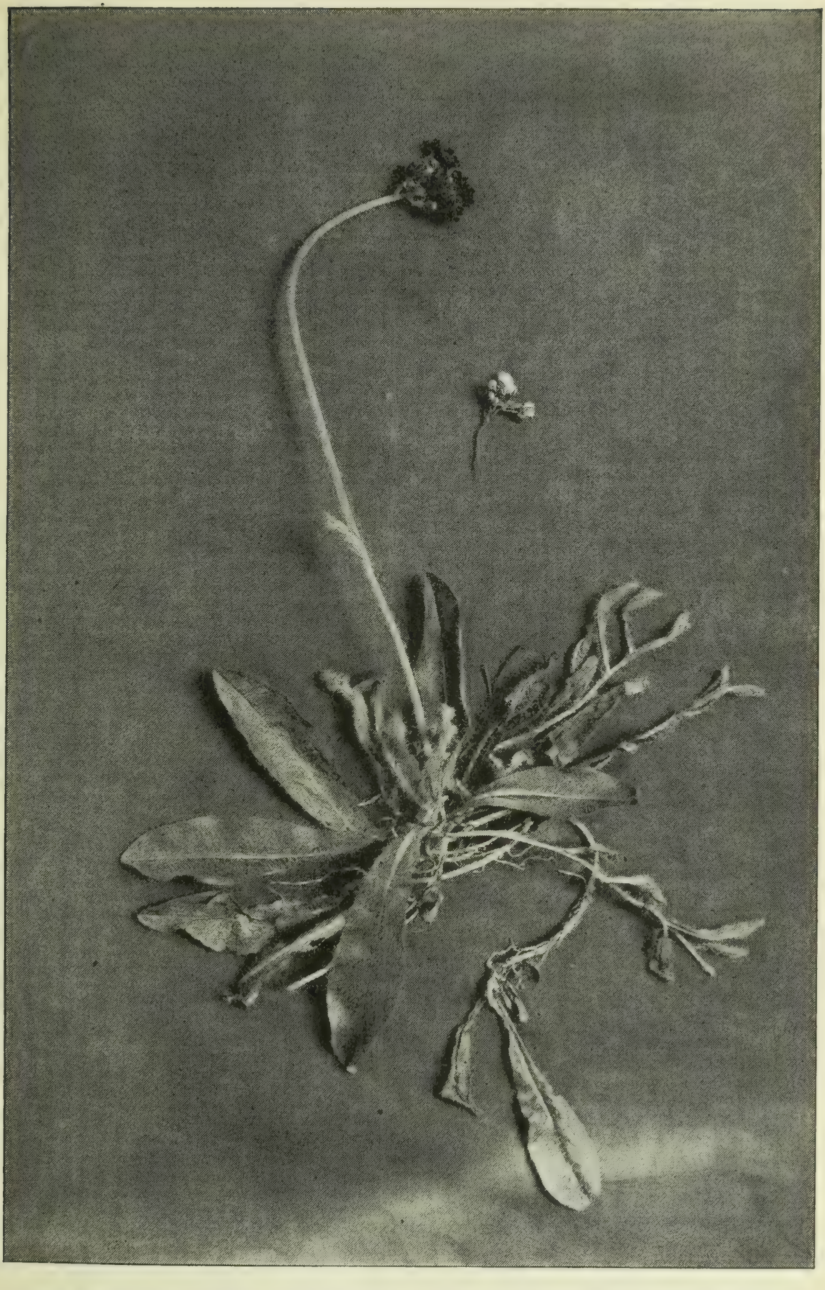
Wild mustard

Wild mustard.— Wild mustard belongs to that class of plants which live for only one year. The seeds, however, will lie in the ground for a long time and grow when not expected to. The plant has rather shallow roots and may be pulled easily if only a few plants are present. If mustard plants are growing in corn, the cultivation will kill most of them.

This pest is often sown with the seeds of such grain as oats. It is more common in this crop than in any other. It is especially troublesome on rich clay land. Sometimes the oat field is yellow with it.

It has been found that this weed may be killed by spraying with copper sulfate. Eight or ten pounds of this is dissolved in fifty gallons of water; or one hundred pounds of iron sulfate may be used in the same amount of water. This is enough for one acre. If the plant is sprayed when it has only six or eight leaves and is about two inches tall, the weed will be destroyed without seriously injuring the oats, barley, corn, or wheat. This spray must not be used in the garden, however, for several plants, such as beets and radishes, are as easily killed as is the wild mustard.

Orange hawkweed.— This is another weed that has two ways of increasing. Besides producing a large number of seeds which fly about like the seeds of the dandelion, it also increases by runners, as does the

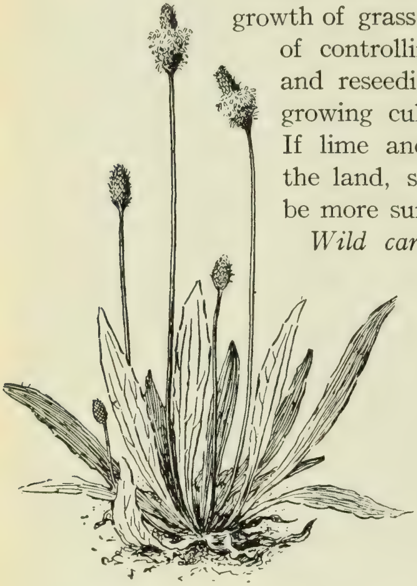


Orange hawkweed, showing spreading stems that produce new plants after the manner of strawberries strawberry plant. In two or three years a large area may be covered by the spreading from a single plant.

Orange hawkweed is common in nearly all parts of the State. It was first introduced from Europe as a garden plant for dooryards and cemeteries. Often it has first been noticed as a weed in the vicinity of old cemeteries. Its bright orange-colored flowers make it an attractive plant for decorative purposes. It has proved to be more ornamental than useful.

Orange hawkweed is the most serious weed in old pastures. It is very common in sour land that will not produce a heavy growth of grass. About the only successful method of controlling it consists in plowing the field and reseeding. The land should be used for growing cultivated crops for one or two years. If lime and stable manure can be applied to the land, success in destroying the weed will be more sure.

Wild carrot.— It is said that the wild carrot is the parent of our garden carrot. The gardener grows carrot seeds by setting out in the spring carrots that were grown the previous year. After producing seeds the plant dies. This is the habit of the wild carrots also. They do not produce seed in the first year. Consequently, if they are cut off near the ground two or three times in the second year, their life history is finished. Wild carrots do not spread from the roots as does the thistle, but they produce a great number of seeds. These seeds have been known to live in the ground for several years before growing; therefore plants must be repeatedly pulled or cut off in order to keep the field free from them. This weed is not troublesome in plowed land, but is common in old meadows.

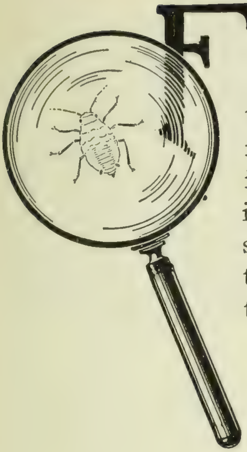


Narrow-leaved plantain

Long-leaved, or narrow-leaved, plantain.— This weed is known also as rib grass and is most prominent in lawns and old meadows. The leaves are narrow, with conspicuous veins, and are two to twelve inches in length. They all arise near the ground. The stem of the plant grows one to two feet high and is terminated by a cylindrical head one to three inches long. The blossoms are yellow. The seeds are small, flattened, and somewhat boat-shaped. The narrow plantain is among the commonest weed seeds found in clover and alfalfa.

INSECT STUDY

The Editors



FOLLOWING are suggestions that may be helpful in teaching insect life:

1. It is not advisable for the children in elementary schools to make a general collection of insects. With the materials that are available in a rural school for taking care of such a collection, it is almost impossible to keep it from being destroyed in a year or two. Children often desire to collect and kill moths and butterflies because of their beautiful coloring. They should be taught that these forms when alive may be attractive, but that dead insects are valuable only for teaching purposes.

2. Collections of the injurious insects may be made every year with advantage to the pupils. A knowledge of economic entomology is important for boys and girls in country districts, because they can help to control harmful insects and an interest is awakened in general insect study. The children might prepare for exhibition a collection of some of the forms of injurious insects in their community, and write compositions on the life history of such insects, giving the measures employed in order to control them. Such work may be used for exhibitions at school, at the county fair, or for Farmers' Week at the State College of Agriculture.

3. For general insect study it will be well to have the children study live forms. To watch the changes in the life of a moth or a butterfly awakens young persons to a realization of the wonders of nature as much as any other observational work. Often in the fall the caterpillar that develops into the monarch butterfly may be found feeding on the milkweed. This caterpillar may be taken into the schoolroom. In order that its development may be watched, fresh milkweed should be kept in a small bottle of water and a lamp chimney placed over the bottle, with a piece of cheesecloth on top of the chimney in order to prevent the caterpillar from crawling out. The children will then have an opportunity to watch the caterpillar change into a chrysalis and perhaps to see the butterfly emerge. The butterfly may be placed in a terrarium and fed sweetened water. The pupils may then watch it take this food through the long mouth parts, which unfold and form a tube. The development of cabbage worms may be watched in the same way. This is real nature study and is of practical import. The children learn the story from the insect

itself, not from a printed page. Such teaching is now being done in many country schools.

4. A very definite piece of work has been accomplished in New York State this year in relation to the apple-tree tent caterpillar. A year ago it was suggested that during the fall and winter the boys and girls in rural schools should collect the egg masses of the tent caterpillar, which were to be found on the small twigs of apple and wild cherry trees. The suggestion was followed by many schools, and the number of egg clusters that were collected in this State is beyond estimate. We hope to obtain a report of this work, and have added a question to this effect on the usual blank for children's names which will be found in the back of this leaflet. We are anxious that each teacher should answer this question, ascertaining from the boys and girls how many clusters were collected in case the school has changed teachers since the work was done. Some idea of the number of clusters collected by the schools can be obtained from a report which was sent to the College during Farmers' Week by Mrs. Emma Cooke Chase, Livingston Manor, New York. Mrs. Chase is a district superintendent in Sullivan county, and the report showed that ten of the schools in her district had collected over 173,000 egg clusters. The following letter from a pupil in a district school is interesting; this school has the best record that has come to us. There were fourteen pupils in the school, and altogether 40,380 egg clusters were collected. The letter is as follows:

District 1, Town of Palatine, Montgomery County,
Palatine Bridge, New York.

Dear Mr. Tuttle:

I am writing you my second letter telling you about how I helped destroy the tent caterpillar.

When my lessons were done in school, I would go out and look for the egg clusters.

It was not a hard thing to do and I enjoyed it. It not only helps to save the trees from this pest, but increases the fruit crop, for many trees are very badly injured by these tent caterpillars.

The number of nests I destroyed was 7926. I got the second prize. There were prizes given. Clarence LeRoy got the first — his number was 8331. Lucile Fusmer got the third — her number was 7207.

Your true friend,
MYRA CONNOR

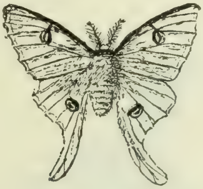
There is work still that can be done along this line. The pest is by no means under control, and it will always be possible to find the egg clusters in the fall and winter and destroy them. It is much better to control the insect in this stage than to try to destroy the caterpillars after they have hatched in the spring. From the year's experience we have learned that the egg clusters may be stripped from the twigs without injuring the trees.

5. Many teachers do not know some of the essentials to the teaching of insect life that every one should have as a background for such instruction. The school library should contain a copy of *Insect Life*, by J. H. Comstock, published by D. Appleton & Co., New York.

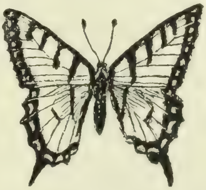
6. Perhaps the commonest mistake made by teachers in connection with lessons on insects is in teaching the differences between moths and butterflies, and the stages in the development of these insects. The following will be helpful to those who have not the necessary knowledge for giving accurate information along these lines:

MOTHS AND BUTTERFLIES

The most important thing to remember in the study of moths and butterflies is that they appear in four different forms during their lives. These forms are the egg, the larva, the pupa, the adult.



Moth

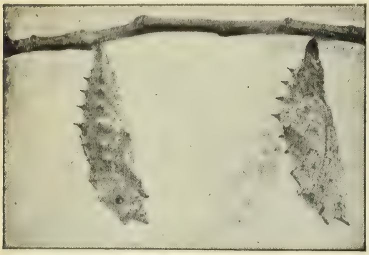


Butterfly

The egg.— The eggs are laid singly or in clusters. They are usually found on the plant that is the favorite food of the young. Look for the shining masses of the eggs of the tent caterpillar on the twigs of apple and wild cherry trees.

The larva.— The larva, or "worm," hatches from the egg. During this period in its history the insect eats and grows. One of the most interesting things to notice in the study of larvæ, or caterpillars, is that as the insect grows it sheds its skin.

The pupa.— Of all the forms in which the moths and butterflies appear, the pupa is the strangest. Although we speak of this period in the life of the insect as one of rest or sleep, it is the time when the most wonderful changes take place in its body. On the next page are shown the pupæ of a butterfly, the mourning cloak. When the caterpillars are about to shed their coats for the last time, they hang themselves head downward from a twig by means of a silken button which they spin. Then they cast off their skins, leaving the chrysalids, or naked pupæ, hanging; they are protected from birds by their spiny form, and are protected from many enemies, even from young naturalists, by their wood-brown color, which very closely resembles the support from which they are suspended.



Chrysalids of the mourning-cloak butterfly

Let us look next at the pupa of a moth. This is nearly always inside a covering which is called a cocoon. If you will examine carefully the fruit trees or shade trees about your home, you may find a cocoon of the Ce-cro-pi-a moth. You will see that it is made of silk. This covering was spun by the larva of the giant silkworm as a protection against the storms of winter. The pupa is inside.

When studying pupæ it should be remembered that butterflies do not come out of cocoons. Their chrysalis, or pupa, is always naked. In the case of moths, however, the pupa is either protected inside a cocoon, or by being underground, or in some well-sheltered place.

The adult.— We now come to the fourth period in the lives of moths and butterflies, the adult forms, and it will be well to learn the distinguishing characteristics of each.

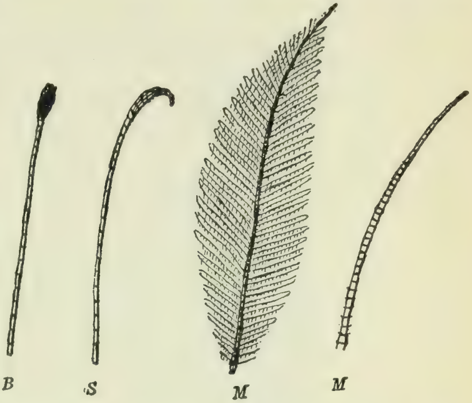
Butterflies have naked pupæ attached to a button of silk. They fly by day. The wings are held erect over the back when at rest. The antennæ, or feelers, have knobs on the apex. The body is slender.

Moths have pupæ protected either inside cocoons, or by being underground, or in some sheltered place. Many moths fly at night. The antennæ are thread-like or feathery, but never knobbed at the apex. The wings are folded flat along the back when at rest. The body is stout.

Occasionally you may come across insects that very closely resemble butterflies, yet have some characteristics that are similar

Cocoon of the Cecropia moth. It is often attached to the twig of a fruit tree to those of moths. They are the skippers, so named because of their peculiar skipping method of flight. The antennæ have knobs, but these knobs are drawn out and turned back in the form of a hook. The body is rather stout. The pupa is sometimes covered by a thin cocoon. The wings are held vertically or horizontally when at rest.

Boys and girls often ask us what they shall feed moths and butterflies. Many of the insects do not eat. Some sip the nectar of flowers or the sap of trees. Oftentimes they will drink sweetened water or the juice of fruit.



Antennæ, or feelers: B, of butterflies; S, of skippers; M, of moths

THE GRASSHOPPER

Anna Botsford Comstock

It is best to place a grasshopper in a tumbler on a spray of fresh herbage, and allow the pupils to observe it at leisure.

The grasshopper earns its name by its powerful jumping, and it performs its jump after the most approved athletic methods. The long hind legs are folded together parallel with the insect's body, and the entire foot, with a spine in the heel, is pressed to the ground. Then, like a steel spring, the long legs straighten and the insect makes a jump that, translated into human terms, would be equal to a man making a standing jump of five hundred feet. Of course this is an excellent method on the part of this insect to escape its enemies, such as birds, skunks, and other animals.

The grasshopper's face has a most comical expression. It is a long face, with the compound eyes placed high on it; and in front of each big eye, and between and below them, are the three tiny simple eyes. The antennæ are short, but alert. There are two pairs of jaws which move sidewise, and connected with these are the palpi, or feelers, which continually tap the food while the insect is eating.

Back of the head is a sunbonnet-shaped piece, bent down at the sides, which forms a cover for the middle part of the body, called the thorax. To the thorax are attached the three pairs of legs, the wings, and the wing covers. The wing covers are not meant for flying, but are held stiff and straight up in the air during flight. The true wings when at rest are folded lengthwise, like a fan, beneath the wing covers. They are strongly veined and circular, and are capable of either short, swift flights, or long-continued flights when the insects occur in hordes and migrate into new territory.

The abdomen consists of rings, as in all insects, and along the lower sides there are two lengthwise creases which open and shut when the grasshopper breathes. The spiracles, or breathing pores, can be seen on each segment, just above this suture. The ears are two large disks, one on each side of the first segment of the abdomen, and can be seen by lifting the wings. The long-horned grasshoppers have their ears in the front elbow, like the katydid.

Grasshoppers lay their eggs in oval masses protected by a tough covering. They are placed in the ground or in decaying wood in the fall. They hatch early in the spring, and the young are therefore ready to attack the tender crops.

SUGGESTIONS FOR STUDY

Which pair of the grasshopper's legs is the longest? Describe how the insect uses these legs in jumping. Why does it need to jump far?

Look at the grasshopper's face. Do you see the large compound eyes? Can you see three tiny dots in the "forehead," which are the simple eyes? Note the antennæ and how they are used.

Watch the grasshopper while it is eating. Do its jaws move up and down or sidewise? Can you see the little feelers connected with the jaws? How are they used?

Study a grasshopper's wings. Note that the upper pair are wing covers. How are they used when the insect flies? Describe how the true wings are folded when at rest. How are they used for flight?

Describe the abdomen. Is it made up of many rings and segments? Can you see on each side of each segment a breathing pore? Can you see on the first segment, beneath the wings, the grasshopper's ear?

Now, note the whole grasshopper. See that there is a head which bears the eyes, mouth, and antennæ; a central part called the thorax, to which the legs and wings are attached; and a third part called the abdomen, in which the ears and the breathing pores are placed.

What becomes of the grasshopper in winter? Where are the eggs laid?

Shuttle of the sunburnt grass,
Fifer in the dun cuirass,
Fifing shrilly in the morn,
Shrilly still at eve unworn;
Now to rear, now in the van,
Gayest of the elfin clan.

From *The Grasshopper*
by EDITH M. THOMAS

THE BLACK CRICKET

Anna Botsford Comstock

Crickets afield

The haunts of the cricket are usually sunny; it digs a little cave beneath a stone or a clod in some field, where it can have the whole benefit of all the sunshine when it issues from its door. The black cricket cannot fly, since it has no wings under its wing covers as have the grasshoppers. The hind legs have a strong femur, and a short but strong tibia with downward-slanting spines along the hind edge, which undoubtedly help the insect in scrambling through the grass. At the end of the tibia, next to the foot, is a rosette of five spines, the two longer ones slanting to meet the foot; these spines give the insect a firm hold when making ready for its spring. When walking, the cricket places the whole hind foot flat on the ground, but rests only on the claw and the segment next to it of the front pairs of feet. The claws have no pads like those of the katydid or the grasshopper; the segment of the tarsus next the claw has long spines on the hind feet and shorter spines on the middle and front feet, thus showing that the feet are not made for climbing but for scrambling along the ground. When getting ready to jump, the cricket crouches so that the tibia and the femur of the hind legs are shut together and almost on the ground. The dynamics of the cricket's leap are well worth studying.

The patent-leather finish to the cricket's clothes is of great use; for, although the cricket is an efficient jumper, it is, after all, mostly by running between grass blades that it escapes its enemies. If we try to catch one, we realize how slippery it is and how efficiently it is able to slide through the fingers.

The cricket's features are not very easily made out, because the head is polished and black; the eyes are not so polished as the head, and the simple eyes are present but are discerned with difficulty. The antennæ are longer than the body and are very active; there is a globular segment where they join the face. The lens reveals to us that the flexibility of the antennæ is due to the fact that they are many-jointed. The palpi are easily seen, a large pair above and a smaller pair beneath the " chin." The palpi are used for testing food and in order to prove whether it be palatable. The crickets are fond of melons and other sweet, juicy fruits, and by putting such food into the cage we can see the insects bite out pieces with their sidewise-working jaws, chewing the toothsome morsels with gusto. They take hold of the substance they are eating with the front feet, as if to make sure of it.

The wing covers of the cricket are bent down at the sides at right angles, like a box cover. The wing covers are much shorter than the abdomen, and beneath them are vestiges of wings, which are never used. The male has larger wing covers than the female, and they are veined in a peculiar scroll pattern. This veining seems to be a framework for the purpose of making a sounding-board of the wing membrane, by stretching it out as a drumhead is stretched. Near the base of the wing cover there is a heavy crossvein covered with transverse ridges, which is called the file; on the inner edge of the same wing, near the base, is a hardened part called the scraper. When he makes his cry, the cricket lifts his wing covers at an angle of forty-five degrees and draws the scraper of the under wing against the file of the over-lapping one; lest his musical apparatus become worn out, he can change by putting the other wing cover above. The wing covers are excellent sounding-boards and they quiver as the note is made, setting the air in vibration and sending the sound a long distance. The wing covers of the female cricket are more normal in venation. The female may always be distinguished from her spouse by the long, sword-like ovipositor at the end of her body; this she thrusts into the ground when she lays her eggs, thus placing them where they will remain safely protected during the winter. Both sexes have a pair of " tail feathers," as the children call them, which are known as the cerci (singular, cerca) and are fleshy prongs at the end of the abdomen.

There would be no use of the cricket's playing his mandolin if there were not an appreciative ear to listen to his music. This ear is placed most conveniently in the tibia of the front leg, so that the crickets literally hear with their elbows, as do the katydids and the meadow grasshoppers. The ear is easily seen with the naked eye as a little, white, disk-like spot.

The chirp of the cricket is, in literature, usually associated with the coming of autumn; but the careful listener may hear it in early summer, although the song is not then so insistent as later in the season. He usually commences singing in the afternoon and keeps it up periodically all night. I have always been an admirer of the manly, dignified methods of this little " minnesinger," who does not wander abroad to seek his lady love but stands sturdily at his own gate, playing his mandolin the best he is able; he has faith that his sable sweetheart is not far away, and that if she likes his song she will come to him of her own free will. The cricket is ever a lover of warmth and his mandolin gets out of tune soon after the evenings become frosty. He is a jealous musician. When he hears the note of a rival, he at once bristles up, lifting his wings at a higher angle and giving off a sharp militant note. If the two rivals come in sight of each other, there is a fierce duel. They rush at each other with wide open jaws, and fight until one is conquered and retreats, often minus an antenna, a cerca, or even a leg.

SUGGESTIONS FOR STUDY

Make some cricket cages in the following manner: Take a small flower-pot and plant in it a root of fresh grass or clover. Place over this and press well into the soil a lantern or lamp chimney. Cover the top with mosquito netting. Place the pot in its saucer, so that it may be watered by keeping the saucer filled. Ask the pupils to collect some crickets. In each cage place a male and one or more females, the latter being readily distinguished by the long ovipositors. Place the cages in a sunny window, where the pupils may observe them at recess, and ask for the following observations. In studying the cricket closely, it may be well to put one in a vial and pass it around. In observing the crickets eat, it is well to give them a piece of sweet apple or melon rind, as they are very fond of pulpy fruits.

Is the covering of the cricket shining, like black patent leather, or is it dull? What parts are dull? Of what use do you think it is to the cricket to be so smoothly polished?

Where did you find the crickets? When you tried to catch them, how did they act? Did they fly like grasshoppers or did they run and leap?

Look carefully at the cricket's legs. Which is the largest of the three pairs? Of what use are these strong legs? Look carefully at the tibia of the hind leg. Can you see the strong spines at the end, just behind the foot or the tarsus? Watch the cricket jump and see whether you can discover the use of these spines. How many joints are there in the tarsus? Has the cricket a pad, like the grasshopper's, between its claws? When the cricket walks or jumps, does it walk on the entire tarsus of each pair of legs?

Study the cricket's head. Can you see the eyes? Describe the antennæ — their color, length, and the way they are used. Watch the cricket clean its antennæ, and describe the process. Can you see the little feelers, or palpi, connected with the mouth? How many are there? How does the cricket use these feelers in tasting food before it eats? Watch the cricket eat, and see whether you can tell whether its mouth is made for biting or for sucking.

Study the wings. Are the wings of the mother cricket of the same size and shape as those of her mate? How do they differ? Does the cricket have any wings under these front wings, as the grasshopper does? Note the cricket when he is playing his wing mandolin to attract his mate. How does he make the noise? Can you see the wings vibrate? Ask your teacher to show you a picture of the musical wings of the cricket, or to show you the wings themselves under the microscope, so that you may see how the music is made.

Why does the mother cricket need such a long ovipositor? Where does she put her eggs in the fall to keep them safe until spring?

Look in the tibia, or elbow, of the front leg for a little white spot. What do you suppose this is? Are there any white spots like it on the other legs? Ask your teacher to tell you what this is.

Can you find the homes of the crickets in the fields? Do the black crickets chirp in the daytime or after dark? Do they chirp in cold or windy weather, or only when the sun shines?

THE MOURNING CLOAK

ANNA BOTSFORD COMSTOCK

You may often see fluttering about the sap buckets and drinking luxuriantly at the spiles during the first warm days of March, and often even in February, a large, brownish black butterfly with wings margined with lighter color. "Why is it here and how did it get here?" is a question that we always ask when we see this fragile creature daring the vicissitudes of our Northern spring. Butterflies seem to belong to the summer and the flowers; yet more than one unfolds its wings to the March wind.

Before the middle of April the mourning-cloak butterflies mate, and early in May eggs are laid in masses about a twig. They are most beautiful little objects, of which some are five-sided and some six-sided. From these eggs hatch little, black, spiny caterpillars, which arrange themselves side by side along the edge of the leaf, with heads all toward the margin, which they begin at once to eat. We reared some of these caterpillars in the insectary one year, and one of the assistants, who had a fine bass voice, discovered that every time he sang all the brood would lift their heads as one caterpillar and bob and tremble in a sort of ecstatic palsy, as if profoundly affected by the music. Naturally he felt much complimented, but later he discovered that pounding on a tin pan, not too loudly, would produce the same effect. We wondered whether this concerted movement might serve to disconcert attacking birds. The caterpillars made no attempt to conceal themselves while eating, and they evidently are not afraid of birds. They are so spiny that they would surely give a sore throat to any bird rash enough to eat them.

The winter problem is one of the severest that insects have to solve in this climate. Each species solves it in its own way; let us find out, if we can, how the mourning cloak meets the difficulty.

SUGGESTIONS FOR STUDY

At what date did you first see the mourning cloak this season?

Why did it not die of freezing in the winter?

Is the first mourning cloak that you see in spring bright in color and perfect in form, or is it somewhat battered and faded?

From your observation on the above questions, you can infer whether the butterfly is fresh from the chrysalis or whether it wintered as a butterfly. Which do you think?

Describe the flight of this butterfly. Does it flutter or does it sail, or does it do both?

Describe the colors and the markings of the wings of the mourning cloak, above and below.

How many legs has the mourning cloak?

Capture a butterfly without harming it, put it into a cage made of mosquito netting, and give it sweetened water in a vial with a small neck. Describe how it gets the water.

Look for the caterpillar at the end of June on the branches of elm trees that show tattered and eaten foliage; or perhaps you will find one scurrying along the walk or the road beneath the trees. Secure such a caterpillar and place it in a mason jar with a little branch of elm, and watch it change to a chrysalis.

How does the caterpillar hang itself up?

Does it weave for itself a loop, as does the cabbage butterfly?

How does it manage to cast off the caterpillar skin without letting go and falling?

What color is the chrysalis?

Can it stir when disturbed?

Can you trace out the wings, the antennæ, and the legs on the chrysalis?

Describe how the butterfly gets out of the chrysalis.

How does the butterfly look when it first comes out? What changes soon take place?

THE ANT

Anna Botsford Comstock

As some things are judged by their economic value, it is probable that Solomon discovered the greatest practical value of the ant when he advised the sluggard to go and study her ways. It is safe to say, however, that no sluggard ever took this advice, for to follow the ant in her devious ways would be too hard work for the idler. As a matter of fact, the economic status of the ant has not yet been determined, and very likely her relationship with other insects will be our final basis for judging whether her performances are useful or detrimental.

For a hundred years we have known that ants used aphids, or plant lice, to obtain food, but only recently have we discovered that this practice of the ants is of economic importance. The aphids live on the juices of plants by inserting their long, sucking tubes into the plant tissues and taking their nourishment as a boy takes cider through a straw. Incidentally, they transform much of the sap into honeydew, which they excrete in drops from the alimentary canal. The ants are very fond of this honeydew and will climb trees and shrubs in order to visit the aphids and thus obtain the sweet food. When an ant wishes honeydew she approaches an aphid and strokes or pats it gently with her antennæ; and if the aphid has not been milked dry by other ants she will promptly produce the coveted substance. Since the ants are such clever creatures, they naturally would defend their aphid herds from any attacking insects, and such defense has been often observed; but we are beginning to believe that there are still more fundamental relations between ants and aphids.

Professor Forbes, in studying the corn root-louse, discovered that the ants care for the eggs of this aphid in their own nests during the winter and take the young aphids out early in the spring, placing them on the roots of smartweed; later, after the corn is planted, the ants move the aphids to the roots of the corn, and thus they preserve this terrible pest, which without their aid would be unable to live and flourish. One species of aphids living on dogwood is protected by stables which a certain species of ant builds around them from mortar made of earth and vegetable matter. Some species of ants are mushroom-growers. Many are the wonderful things which these little insects accomplish.

Many of our common ants live in ant hills or build their tunnels in the earth; in the latter case, they usually have the openings of their tunnels beneath stones in fields. At the gateway in any ants' nest there are likely to be sentinels stationed, to give warning of intruders. When a nest is disturbed the ants run in every direction to get out of the way. If, however, there are in the nest any of their young, in either the larva or the pupa stage, the ants are never too frightened to take them up and try to carry them to places of safety.

Ants' eggs are very small objects, each about the size of the point of a pin. The larvæ that hatch from these eggs are translucent little grubs, looking like grains of rice but more pointed at one end. The pupæ are yellowish, are covered with a parchment-like skin, and resemble grains of wheat. They are commonly called ants' eggs. When the pupa skin breaks, the full-grown ant appears, and at first is pale in color.

Often there are in the same colony ants of two sizes: the large ones are called majors and the small ones minors. Whatever their size, however, they all work together to bring food for the young and to care for the nest.

During most of the year the ant colony consists only of workers and laying queens, but in early summer the nest may be found swarming with winged ants. These are kings and queens. Some warm day these winged ants will issue from the nest and take their marriage flight, the only time in their lives when they use their wings. After the marriage flight, the ants fall to the ground. In this way undoubtedly a large number perish. In most species, we know that the queens find refuge in some shelter and there lay their eggs. Perhaps many of them are adopted into other colonies of the same species. The queen sheds her wings after the marriage flight.

In an ants' nest there may be more than one queen, for ants differ from honeybees in this respect. Each queen has her own apartment, and is well cared for by her ladies in waiting. They feed her and groom her, so that she is able to give her whole time and energies to producing eggs. As soon as she lays an egg, it is taken by some of the nurse ants and carried to a nursery, which contains other eggs of about the same age. Whether the nurses by their care are able to retard or hasten the hatching of the eggs we do not know. We do know that in many of the ants' nests the nurseries remind us of a graded school, because a large number of just about the same age are to be found in the same nursery; and it is undoubtedly a fact that the ant nurses, by feeding some more than others, are able to keep the whole brood in about the same stage of development. When the larvæ are young they are fed on regurgitated food, but as they grow older the food is brought to them or they to the food and they do their own feeding. In one of my nests I placed a part of the yolk of an egg, hard-boiled, and the ant nurses dumped the larvæ down around the edges of it; and there they munched industriously until through their transparent bodies I could see the yellow of the egg for the whole length of the alimentary canal.

The ant nurses are very particular about the temperature of the nurseries, and are even more careful lest the young suffer from drafts. Thus they are obliged to move them about in the underground nests, carrying them down to the lower nurseries in the heat of the day and bringing them up nearer to the warmer surface during the evening. This moving is always done carefully; and, while an ant's jaws are formidable weapons, she carries her baby sisters with gentleness. The ant nurses keep the larvæ and the pupæ very clean by licking them. When a youngster issues from the pupa skin, the nurses hasten to help her straighten out her cramped legs and antennæ, feed her assiduously, and help her make her first toilet.

An ants' nest

Ants are very cleanly in their nests, and will carry out of it any débris or foreign substance. Although their chief work is the building of their underground galleries, the care of the young, and the bringing of food to the nests, yet they are also efficient fighters. There are many stories of ant battles which have been waged furiously from dawn until evening, and continued with unabated fury for successive days. We do not know all the reasons for wars among ants, but in some observed instances they have been caused by one colony trespassing on the territory of another. In other cases, war has followed an attempt on the part of one species to capture the young of another species in order to rear them as slaves in their own nests. Slavery among ants has its mitigations, for the slaves are treated like the other members of the family, except that their duties are of the domestic sort and they are not allowed to go to war. The ants never seek to enslave a full-grown ant, but capture only the larvæ and the pupæ, which they rear in their own nests.

If you take one ant and study her appearance, you will find that her body is divided into three parts: the head, which bears the not very distinct eyes; the antennæ, which are the ant's chief means of acquiring knowledge of the world around her; and the jaws, which are large and work sidewise, like a pair of shears, and are armed with triangular notches along the biting edge. Miss Fielde has shown us that the different segments in the antennæ of an ant are used for detecting different things. For instance, the tip segment detects the odor of an ant's own nest, and enables her to distinguish this from other nests; through the next segment she is able to recognize her sisters wherever she finds them; and through the third segment she recognizes the odor of her own feet and thus is able to retrace her own steps.

The thorax bears the three pairs of legs, and, in the case of queens and kings, two pairs of wings. The ant's legs are very efficient; she is an excellent runner, and she can take astonishing leaps when pursued.

The abdomen is attached to the thorax by a very narrow connection, so that most ants are slim-waisted. The abdomen consists of several segments and has breathing pores along the sides, which are difficult to detect.

SUGGESTIONS FOR STUDY

Describe all the different kinds of ants' nests that you have found. Where were they? How were they built?

If you disturb an ants' nest, how do the ants act? Do they usually try to save themselves alone? Do they seek to save their young at the risk of their own lives?

In nests under stones, can you find the young of the ants? How do they look? How can you tell an ant larva from a pupa.

Do you find ants carrying objects to their nests? Are these for food? How does an ant manage to carry an object larger than herself?

Do you find winged ants in a nest? If so, catch a few in a vial and compare them with the workers. Do you know what these winged ants are, and why they have wings?

Describe the shape of the ant's body. How many parts are there to it? Describe the head and all the organs on it. Describe the thorax, or the central part. To which part are the legs attached?

Does an ant keep her antennæ in motion? Why? Does she use them in conversing with her companions? How does an ant clean her antennæ?

Feed an ant sirup or honey and describe how she eats it.

With what does the ant grasp an object which she is carrying?

Note an ant when she is visiting aphids, or plant lice. How does she treat the aphids? What do they do in response? Do you think the ants and the aphids are friendly to each other? Why?

Reference books on the subject are *Ant Communities*, by H. C. McCook, and *Insect Stories*, by Vernon L. Kellogg (pages 65 and 285).

THE BUMBLEBEE

ANNA BOTSFORD COMSTOCK

Among the bumblebees only the queens, or mothers, of the colony survive the winter. In early May, the most delightful of spring visitants is one of these great, buzzing, queen bumblebees, flying low over freshening meadows, trying to find a suitable place for her nest. The farmer or fruit-grower who knows his business is as anxious as she that she find comfortable quarters, so that she and her children may render aid in fertilizing his fruit. She usually selects a cozy place, such as the deserted nest of a field mouse, and begins to build her home. She gathers pollen and nectar from the early blossoms; these she makes into a special kind of beebread which is packed in an irregular mass in the nest. On this she lays a few eggs. Each small bee grub, as soon as it hatches, burrows into the beebread, making a little cave for itself, which might remind one of a boy eating out a cave in a big sponge cake. After the grub is fully grown, it spins about itself a cocoon, in which it changes to a pupa, and a little later comes out a full-fledged bumblebee about half as large as its queen mother. These workers, or daughters, of the bumblebee family go to work very soon, gathering pollen and mixing it with nectar, and making larger masses for the young to burrow in. Meanwhile the queen mother remains at home and lays eggs so as to enlarge the colony.

The workers later strengthen the silken pupa-cradles with wax and thus make them into cells for storing honey. The reason why the bumblebee comb is so disorderly in its arrangement of cells is because the cells are made by the youngsters burrowing in every direction.

All the eggs in the bumblebee nest in spring and early summer develop into workers. Late in summer the queens and the drones are developed — the drones, as with the honeybees, being the mates for the queens; but of all the numerous inhabitants of the bumblebee nest, only the queens survive the winter.

There are many species of bumblebees, of different sizes. Each bee has short, active antennæ, and a mouth fitted for biting as well as for sucking. The wings are four in number and strong. The front legs are short; all the legs are covered with hairs and end in a three-jointed foot tipped with a claw. On the hind leg, the tibia and the first joint of the foot are enlarged to form pollen baskets. One of the most interesting observations that it is possible to make is to note how the bumblebee brushes the pollen from her fur and packs it into her pollen baskets.

A bumblebee may be imprisoned in a tumbler for a short period for observation, and then allowed to go unharmed. The pupils should be encouraged to give close attention to the manner in which bumblebees get nectar and pollen from the flowers; for of all insects the bumblebee is the truest friend of most of our wild flowers, since she carries the pollen from one to another. Our red clover cannot be fertilized without the help of the bumblebees. These bees also do a very great work for all our fruit trees, and therefore should be protected in every possible way.

SUGGESTIONS FOR STUDY

In how many flowers do you find the bumblebee? Watch her closely and see how she gets the nectar. Notice how she "bumbles around" in a flower and becomes dusted with pollen. Watch her and note how she gets the pollen off her fur and packs it in her pollen baskets.

On which legs are her pollen baskets? How does the pollen look when packed in them? What does the bee do with pollen and nectar?

Catch a bumblebee in a jelly glass and look at her closely. Can you see three little eyes between the big compound eyes? Describe her antennæ. Are they active?

How many pairs of wings has she? Which pair of legs is the shortest? How many segments are there in the leg? Do you see the claws on the foot?

What is the bumblebee's covering? What is the color of her "plush"? Is she furry above and below?

Have you seen the very large queen bumblebee in spring, flying near the ground, hunting for a place in which to build a nest? Why must you be very careful not to hurt her? How does she pass the winter? What does she do first, in starting the nest?

In how many ways does the bumblebee benefit us?

Hot midsummer's petted crone,
Sweet to me thy drowsy tone
Tells of countless sunny hours,
Long days, and solid banks of flowers;
Of gulfs of sweetness without bound
In Indian wildernesses found;
Of Syrian peace, immortal leisure,
Firmest cheer, and bird-like pleasure.

From *The Humble-bee*
by RALPH WALDO EMERSON

BITING AND SUCKING INSECTS

GLENN W. HERRICK

Editors' Note.— The syllabus states that one biting and one sucking insect should be taught during the year, and in the following pages we are presenting several brief lessons from which selection for this work may be made. From the following list the teacher will learn to which class each insect belongs.

Name of insect	Mouth parts
Codling moth	Larva, biting Adult, sucking
Elm leaf-beetle	Biting
Colorado potato beetle	Biting
May beetle	Biting
Common squash bug	Sucking
Plum curculio	Biting
Apple-tree tent caterpillar	Larva, biting Adult, sucking
House fly	Sucking
House mosquito	Sucking
Imported cabbage butterfly	Larva, biting Adult, sucking
Striped cucumber beetle	Biting
Croton bug, or cockroach	Biting

THE CODLING MOTH

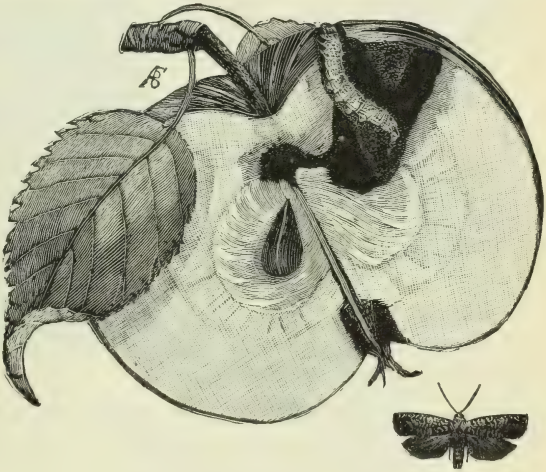
(*Carpocapsa pomonella*)

Appearance of the moth.— This is a small moth, but it varies somewhat in size. When the wings are outspread they are never more than three quarters of an inch from tip to tip. The front wings are brownish gray and are crossed by many dark and white wavy lines. Near the tip of each wing is a brown-colored spot with coppery or golden-colored patches that shine when the moth is held at the right angle. The hind wings are grayish brown and bear a delicate fringe of hairs. The color of the moth resembles the gray bark so closely that when the insect is resting on an apple limb, with its wings folded on its back, it can hardly be distinguished.

Story of its life.— The moth appears and lays its eggs on the fruit and the leaves two or three weeks after the blossoms fall. The eggs hatch in about a week and the majority of the young caterpillars enter the apples through the blossom ends. Each one lives in the apple for about four weeks, and when full grown it leaves the fruit through a hole in the side. It then crawls to a crevice in the bark on the trunk, spins a cocoon, and may change to a pupa and transform to a moth in the latter part of July. If so, the moth will lay eggs for another brood of caterpillars. These second-brood caterpillars, and some of the first brood that did not change to pupæ, live over the winter on the trunks of the trees in crevices of the bark and transform to moths in the spring, thus completing the life cycle.

Injury and control.— The caterpillars burrow inside of the fruit and cause what we call wormy apples (see figure). This insect is said to cause an annual loss to apple-growers of $12,000,000, to say nothing of the cost of spraying for its control.

The insect can be controlled by spraying as soon as three fourths of the blossom petals have fallen, with two pounds of arsenate of lead to fifty gallons of water. This should be done thoroughly, and in most cases the spraying may well be repeated in three weeks. Finally, a spraying may be necessary in the last week of July for the second brood of caterpillars.

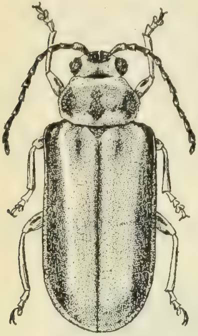

Codling moth. Larva and adult

THE ELM LEAF-BEETLE

(*Galerucella luteola*)

Appearance of the beetle.— The insect is about one fourth of an inch long. In general it is yellowish or brownish yellow in color, with a dark line along each side of its back. However, its color varies somewhat, and the over-wintering beetles are often so dark-colored that the brownish yellow almost disappears and the black lines are hardly noticeable. It is quite likely to be confused with the common striped cucumber beetle, although it is considerably larger.

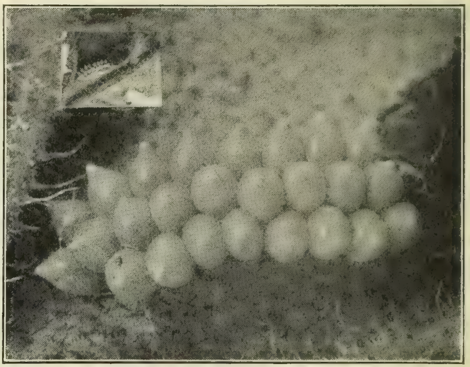
Story of its life.— In the fall of the year the full-grown beetles search for nooks and crannies in which to pass the winter, and many of them enter the attics of houses. In spring they awake and fly out to the elm trees that are just coming into leaf. Here they eat round holes through the leaves, and soon lay their orange-colored eggs in varying clusters of five to twenty-five on the underside of the leaves. The eggs hatch in five or six days into the grubs, which eat ravenously and grow very fast, becoming mature in fifteen to twenty days. When full-grown they drop or crawl to the ground at the base of the trunk and change to golden pupæ. In six to ten days the pupæ transform to adult beetles, which lay eggs for another generation.



An adult elm leaf-beetle, much enlarged

Injury and control. — The beetles gnaw holes in the leaves and the grubs eat the leaves so that they curl, wither, and die. In a few seasons the trees will begin to bear dead branches and finally may die.

The beetle can be controlled by spraying the trees with arsenate of lead, three pounds to fifty gallons of water. Large trees can be sprayed for seventy-five cents to a dollar each.



Eggs, natural size and much enlarged

THE COLORADO POTATO BEETLE

(*Leptinotarsa decem-lineata*)

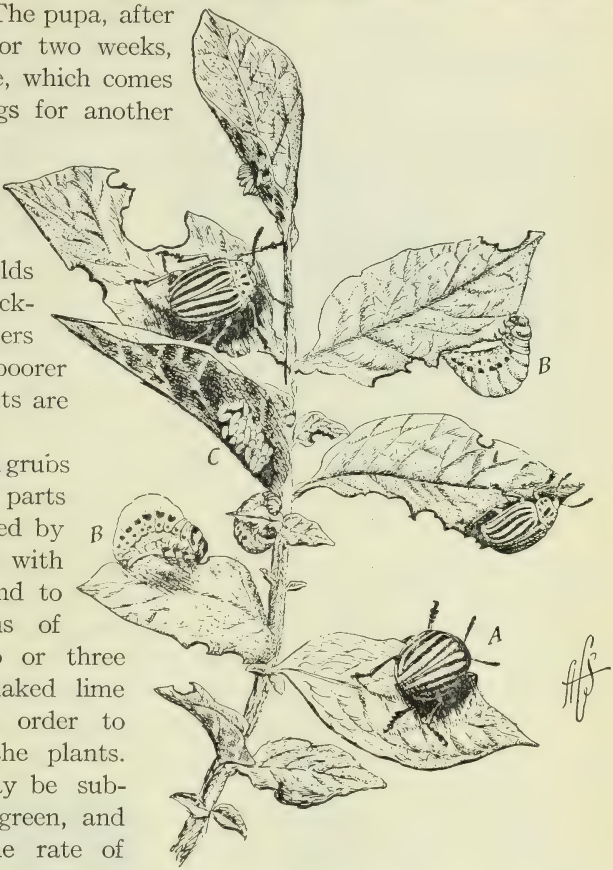
Appearance of the beetle.— This is a robust-looking insect nearly half an inch long, with a ground color of light brownish yellow, almost reddish yellow at times. Each of the wing covers is ornamented with five black lines running lengthwise. The thorax is marked with ten or more dark spots, while the head is small and bears one dark, three-cornered spot.

The mouth parts of the beetle consist of two pairs of jaws, the upper pair being dark-colored, hard, and horny. These enable the beetle to bite off bits of leaves and stems, which it chews and swallows.

Story of its life.— In the fall of the year the adult beetles burrow into the ground, where they pass the winter. In spring they work their way out of the ground early, and, after feeding on the potato plants for a few days, deposit their orange-colored eggs in clusters on the underside of the leaves. The eggs hatch in a week or ten days, and the soft red grubs begin eating the leaves of the plant greedily. The grubs become full-grown in two or three weeks and go down into the ground, where each one changes to a pupa. The pupa, after resting for ten days or two weeks, transforms to a beetle, which comes forth ready to lay eggs for another generation.

Injury and control.— The beetles and grubs eat the plants and destroy whole fields of potatoes if not checked. Moreover, the tubers in the ground are of a poorer quality when the plants are injured by this insect.

Since the beetles and grubs have biting mouth parts they may be controlled by spraying the plants with paris green, one pound to one hundred gallons of water, to which two or three pounds of freshly slaked lime should be added in order to prevent burning of the plants. Arsenate of lead may be substituted for the paris green, and should be used at the rate of three pounds to fifty gallons of water. In many cases two or more applications of poison may be necessary.



Potato stalk with beetle at work: A, beetle; B, grub, or slug; C, eggs

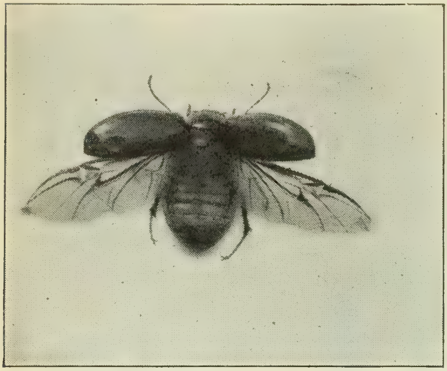
Natural enemies.— Perhaps the most efficient enemies of the potato beetles are the ladybird beetles. At least eight different kinds of ladybirds attack and destroy the potato beetle in some of its stages. Both the adult ladybirds and their larvæ feed on the eggs and grubs of the potato beetle and destroy great numbers of them.

There are also several kinds of rather large, dark-colored beetles, known as ground beetles, which prey on the potato beetle and its grubs.

A certain fly, called a tachina fly, lays its eggs on the grubs. The eggs hatch and the maggots bore through the skin of the grub and live inside its body, finally killing it.

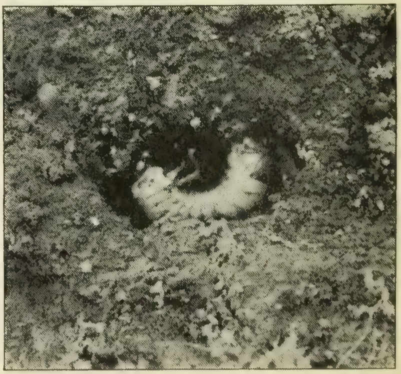
THE MAY BEETLE

(*Lachnosterna* sp.)


The May beetle with wings spread

Appearance of the insect.— There are eight or nine species of May beetles, the larvæ, or white grubs, of which are injurious to certain farm crops. The beetles themselves are, for the most part, mahogany-brown in color and vary from one half an inch to over an inch in length. A May beetle has a pair of hard, brown wing covers on the back, which meet in a straight line down the middle of the back and partly cover the sides of the body. Underneath the wing covers is folded a pair of thin, translucent wings. Each beetle is provided with a pair of stout, black, biting jaws. The legs are long and slender, and each ends in two sharp, curved claws.

Story of its life.— The eggs of the May beetle are laid each in a ball of earth a few inches below the surface of the ground. These hatch in ten days or two weeks, and the white grubs pass their whole life in the soil. It is fairly certain that the life history of most of the injurious May beetles extends over a period of three years. The grubs have a brownish head, a pair of black, horny jaws, and six strong legs. The body of a white grub is always in a half-curled, C-shaped position. The grubs grow slowly in the soil. During the first summer they are small and cause little injury; in the second summer they are larger and destroy more; while in the third summer they are large and ravenous, and do most of their injury.


A white grub, the larva of the May beetle, in cell in soil

Injury and control. — White grubs injure grasses in meadows, pastures, and lawns, corn, oats, strawberries, potatoes, and the roots of young forest trees. There is nothing that can be put on the fields to kill the white grubs. In the case of a lawn or a similar small area, the soil may be soaked with a ten-per-cent solution of kerosene emulsion, which should then be washed in by soaking the ground with water.

Pigs are excellent agents for ridding infested soil of white grubs. They root over the whole surface of a field and catch every grub within reach, even going to a depth of a foot or more in quest of the insects.

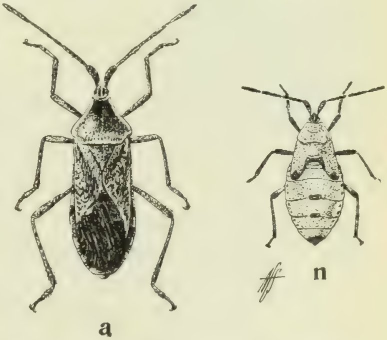
Corn, oats, and other grass-like plants and potatoes are liable to injury from white grubs when sown or planted on newly turned sod, especially if the sod is more than two years old. There is always some risk from injury by these pests if sod land is planted to corn or potatoes. Probably the most effective way of preventing the ravages of the white grubs is to practice a three- or four-years rotation. Moreover, we believe this to be, in the majority of cases, good agricultural practice. By rotating crops the land need not remain in grass longer than two years at most, and the white grubs will be prevented from gaining a foothold.

It has been noted that crows and blackbirds go to plowed fields and feed on white grubs.

THE COMMON SQUASH BUG

(*Anasa tristis*)

Appearance of the squash bug.— The adult bug is usually more than half an inch long; very large ones may be nearly three fourths of an inch in length. It is blackish brown above and specked with yellow underneath. Its head is small and narrow and bears a prominent black eye on each side. Reaching out in front are two long antennæ, the joints of which are long enough to be counted with the naked eye. On the underside of the head is a long, slender beak, which is carried close to the body between the first two pairs of legs. This beak constitutes the mouth parts of the bug, making it, therefore, a *sucking insect.*



The squash bug: a, adult; n, nymph

The beak has a deep groove on the upper side. Lying in this groove are four tiny, thread-like bodies. These have fine, saw-like teeth at their free ends, and are used by the insect to puncture a leaf or a stem. The juice of the plant is then drawn into the mouth of the insect.

Story of its life.— The full-grown bugs hide in the fall beneath stones, boards, leaves, and any rubbish that they may find. In spring they come from their hiding places and begin their search for squash vines. When they find the plants they soon commence to lay their brown eggs on the underside of the leaves, and sometimes on the upper side also. Occasionally the eggs are laid in regular rows, as shown in the illustration. In eight to twelve days small green and black bugs hatch from the eggs. They are somewhat like the full-grown bugs, but without wings and with long legs. They are called nymphs, and each one has a beak with which it punctures the leaf and sucks out the juices. The nymphs grow and shed their skins five times before they become adults. More than a month is usually required for the bug to reach full size.

Eggs of a squash bug on a leaf

Injury and control.— The squash bug punctures the leaf, sucks out the juice, and injects into the leaf a poison that kills the cells and causes the leaf to turn brown and wilt. It also carries a disease from one vine to another that may cause the death of the plants.

Poisons will not kill the bugs, but early in the spring one should keep a sharp lookout for the old bugs and catch them by hand before they lay their eggs. A little later the eggs may also be destroyed.

The bugs may be trapped under pieces of boards, bark, or shingles laid on the ground. The bugs will crawl under these for shelter and may be caught and killed.

THE PLUM CURCULIO

(*Conotrachelus nenuphar*)

Appearance of the insect.— The plum curculio is a small beetle, about a quarter of an inch in length. It has a slender snout, or proboscis, with a sharp pair of jaws at the tip and with a pair of antennæ arising from near the end. On the back of the beetle are four conspicuous humps, and near the end of the body is a patch of reddish white hairs.

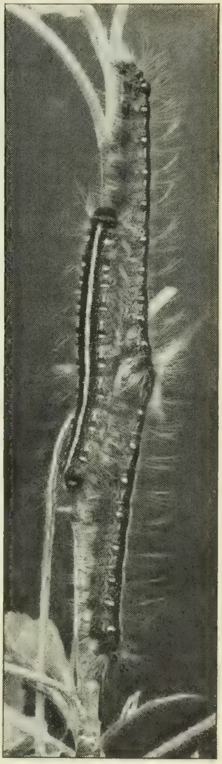
Story of its life.— The beetles hide away in the fall under leaves and among rubbish along hedgerows, stone walls, and similar places. In the spring they come forth and fly to the plum, cherry, peach, and apple trees and soon begin depositing their eggs in the young fruit. The female makes a crescent-shaped cut underneath each egg. The eggs hatch in about one week, and the small, white, curved grub lives in the fruit for two to three weeks. When full-grown it leaves the fruit and enters the soil to a depth of one to two inches, where it changes to a pupa. In three to four weeks the pupæ have trans-

Plum curculio, much enlarged

formed to beetles, and the latter have emerged from the soil. The beetles of this new generation feed on the fruit and the foliage until cold weather, when they hide away for the winter.

Injury and control.— The beetles injure the fruit by eating circular cavities into it, and by making crescent-shaped marks in it. The fruit often becomes knotty and deformed as a result of the punctures by the beetles. In addition, the grubs in the fruit cause the latter to fall and to decay.

The injuries of the curculio may be controlled by cleaning up hedgerows and other places where it hibernates. In addition the infested trees should be sprayed with arsenate of lead, three pounds to fifty gallons of water, as soon as the blossoms fall and again in ten days.



Apple-tree tent-caterpillars

THE APPLE-TREE TENT-CATERPILLAR

(*Malacosoma americana*)

Appearance of the insect.— The mother moth is dull yellowish or reddish brown, with two whitish or pale yellow stripes across each wing. The caterpillar larvæ are two inches or more in length, and are velvety brown spotted with purple and yellow and with a whitish line the whole length of the back. They are also more or less clothed with long, yellowish hairs (see figure).

Moth of the apple-tree tent-caterpillar

Story of its life.— The mother moth deposits her eggs in a ring-like mass around the smaller twigs of a tree, and covers them with a firm cement, like varnish, which holds the eggs in place and keeps out the rain. Here the eggs remain all winter, and hatch in the spring about as soon as the buds burst. The caterpillars eat the buds and the leaves, grow very fast, and by the first week in June become mature. Each one then finds a nook or a cranny in which to spin a thick, silken cocoon, covered with a yellowish powder. Inside of the cocoon the caterpillar changes to a pupa, which transforms to a moth in the latter part of June. The moths soon deposit their ring-like masses of eggs and then they die.

Injury and control.— The moths do no harm, but the caterpillars eat the buds and the leaves and defoliate the trees. This weakens the trees, stops the new growth, and prevents the production of fruit.

The insect can be controlled by collecting the egg-rings during the fall and winter, and by spraying the trees with arsenate of lead, three pounds to fifty gallons of water, once after the leaves appear but before the blossoms open, and again after the petals fall.

Egg mass of the apple-tree tent-caterpillar

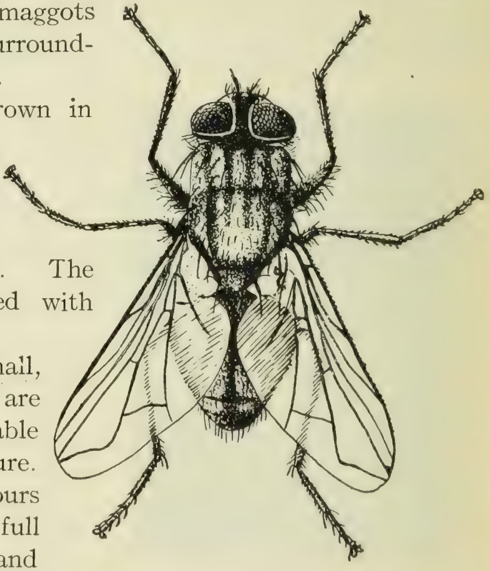
THE HOUSE FLY

(*Musca domestica*)

Appearance of the fly.— Several kinds of flies are often mistaken for house flies. The house fly varies in size according to the quantity of food that the maggots obtain and to the temperature surrounding them while they are growing.

The house fly is grayish brown in color, with four dark lines on the thorax just behind the head; and one of the main long veins in each wing turns abruptly upward at the end. The body and the legs are covered with rather long, stiff hairs.

Story of its life. — The small, white, slightly curved eggs are laid among decaying vegetable material, especially horse manure. They hatch in twenty-four hours into maggots, which reach their full growth in five or six days and change to dark brown objects known as puparia. The pupæ, inside the puparia, rest quietly for about five days, and then transform to the adult flies. There may be eight or ten generations



An adult house fly. Much enlarged

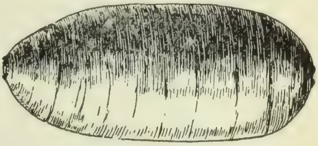
each season — each generation, of course, containing more flies than the preceding one.

Eggs of a house fly. Enlarged

Injury and control.— House flies are known to be carriers of typhoid fever, cholera, dysentery, and other intestinal diseases, and are therefore very dangerous insects to allow in the house.

Larva, or maggot, of a house fly. Much enlarged

All stable manure should be drawn to the fields once a week, or put in a dark, tight room or pit. The closet or outhouse should be tight so that no flies can enter it. The windows to kitchens and other rooms should be screened against flies. Flies should be caught in traps or on tanglefoot paper, or killed with formalin baits. Two tablespoonfuls of formaldehyde (40 per cent) in a pint of equal parts of milk and water, set about the room in plates, will attract the flies and kill many of them, provided there is no other food or water for them to feed on. A piece of bread placed in the middle of each plate for the flies to alight on will make the bait more attractive. A constant warfare should be maintained against house flies.



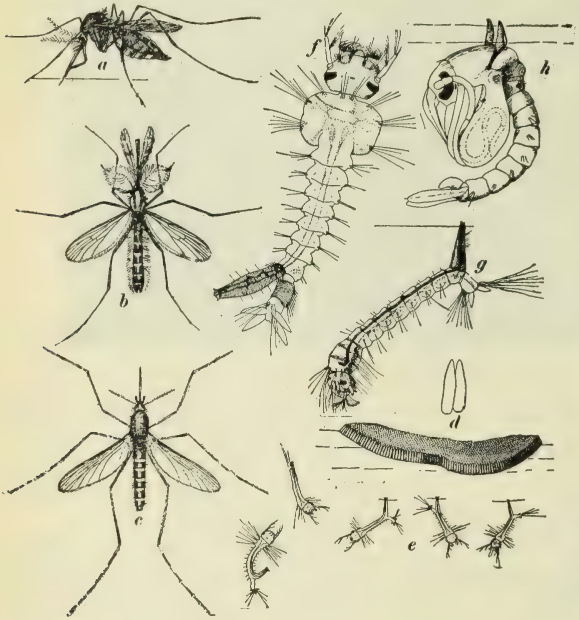
Pupa of a house fly. Much enlarged

THE HOUSE MOSQUITO

(*Culex pipiens*)

Appearance of the mosquito.— The house mosquito is a small fly with two wings, long, slender legs, and a slender proboscis, or beak, with which it penetrates the skin and sucks the blood. The male mosquito has hairy appendages on the head, but does not "bite."

Story of its life.— The house mosquito lays its eggs in boat-shaped masses, which float on the surface of water in rain barrels, tin cans, ponds, streams, and pools. The masses of eggs are dark brown, and look like minute specks or soot floating on the water. In one or two days the eggs hatch into tiny wigglers, or larval mosquitoes. These wigglers, or wrigglers, are very active, but they have a tube on the end of the body through which they take in air, and therefore they rest during a part of the time near the top of the water with the head hanging downward and the tip end of the tube projecting into the air. In about a week the wigglers change to pupæ, which appear to have large heads and slender tails.



Life story of a Culex mosquito: (a) and (c) females; (b) male; (d) eggs; (e) young wigglers; (f) full-grown larva, or wiggler; (g) larva in feeding position at surface of water; (h) pupa. All enlarged. (Adapted from Howard)

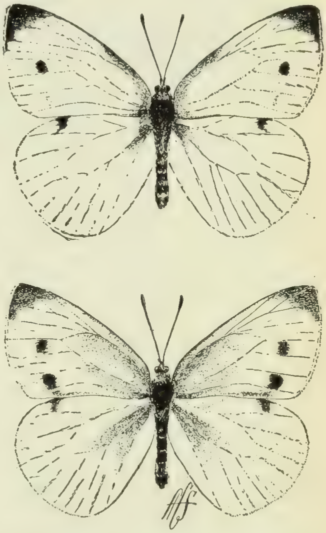
The pupæ live for four or five days, when the skin breaks open along the back and the mosquito crawls out, dries its wings, and flies away.

Control.— Drain all pools and ponds of water, and empty tin cans and rain barrels in which mosquitoes may breed; or pour oil on top of the water, which will kill the wigglers. Sometimes small fish, such as minnows, can be put into ponds and pools, and these will destroy the wigglers. The windows and porches of houses may be screened as a protection from the annoyance of mosquitoes.

THE IMPORTED CABBAGE BUTTERFLY

(*Pontia rapae*)

Appearance of the insect.— The parent butterfly has two pairs of large, strong, white wings. Each of the front wings has a black patch in the outer corner; the wings of the mother butterfly bear two black spots in addition, while those of the father insect bear but one black spot or patch. The wings are sulfur or straw-color on the underside. The body of the butterfly is long and slender, and dark in color. The long, slender feelers, or antennæ, project from the head. Each antenna ends in a swollen knob. The caterpillar is velvety green in color, and about one and one fourth inches in length when full-grown. There are a faint yellow stripe down the middle of the back and a row of yellow spots along each side of the body.

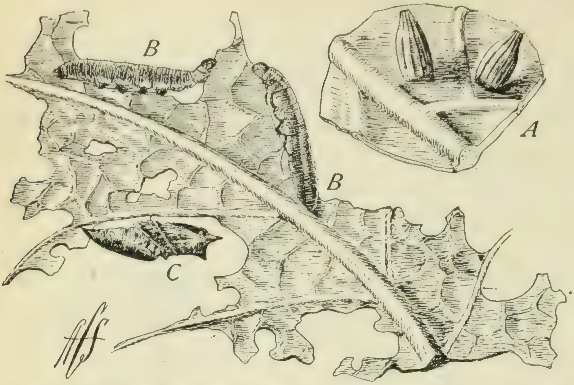


The imported cabbage butterfly; male above, female below

Story of its life. — The butterflies appear early in the spring, and the mother insect soon begins to deposit her whitish or pale yellow eggs on the leaves of the cabbage, one in a place. These hatch in about one week, and the tiny green worm appears. The velvety green caterpillars become full-grown in about two weeks, and each one transforms to a pupa which, owing to its peculiar appearance and silvery markings, is called a chrysalis. The chrysalis may be fastened to a cabbage leaf or to a board or paling in a near-by fence. The insect remains in the chrysalis stage for one to two weeks, when the butterfly appears, thus completing the life cycle, which is passed in twenty-two days to five weeks. There are at least three broods in a season in New York.

Injury and control.— The caterpillars riddle the outer leaves of the plant and crawl down into the head, where they injure and soil the tender white leaves.

This cabbage pest is best controlled by spraying the plants with one of the arsenicals, paris green or arsenate of lead. There is no danger in spraying cabbages with a poison up to the time when they are half grown, and even later. The outside leaves never fold up about the head, hence there is little danger of enclosing the poison within the cabbage.



Parts of cabbage leaf, with eggs at A, caterpillars at B, and chrysalis at C

If paris green is used it should be applied at the rate of one pound to one hundred and fifty gallons of water, or sifted on dry, in the latter case being thoroughly mixed with flour at the rate of one pound to twenty-five pounds of flour. This should be applied in the morning, when the dew is yet on the cabbage leaves.

Arsenate of lead may be applied at the rate of two and one half pounds to fifty gallons of water.

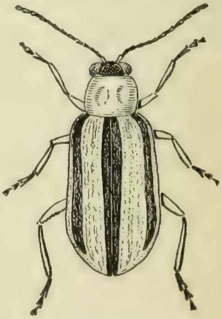
THE STRIPED CUCUMBER BEETLE

(*Diabrotica vittata*)

Appearance of the beetle.— The beetle is only about two fifths of an inch long. Its ground color is yellow above, with a black head and with three black lines running lengthwise of the back. The underside of the body is mostly black. The larva is a slender, white, worm-like grub, which lives below the ground on the stem and roots of cucumbers.

Story of its life.— The beetles spend the winter hidden away beneath leaves and other rubbish, but they appear early in spring and feed on such flowers as they can find until the cucumbers and melons are up. They lay their eggs in crevices of the soil near the roots of the melon plants, where they hatch, and the white, slender larvæ live for about one month. When full-grown the larvæ change to whitish pupæ, and in about a week the adult beetles appear. The life cycle occupies probably about six weeks, and there are two generations a year in New York and perhaps three on Long Island.

Injury and control.—In spring the hungry beetles eat the leaves and flowers of the young plants of cucumbers, melons, and squashes, and cause severe injury, sometimes destroying the plants. The slender larvæ also do some injury by gnawing into stems underground, and into the roots.



Striped cucumber beetle, enlarged

Plants may be protected from these beetles by putting boxes around them, by keeping the leaves covered with finely sifted ashes or air-slaked lime, by planting an excess of seeds, by spraying the plants with arsenate of lead (two and one half pounds to fifty gallons of water), or by sprinkling powdered arsenate of lead on them. Whatever is done must be done thoroughly and often.

THE CROTON BUG, OR COCKROACH

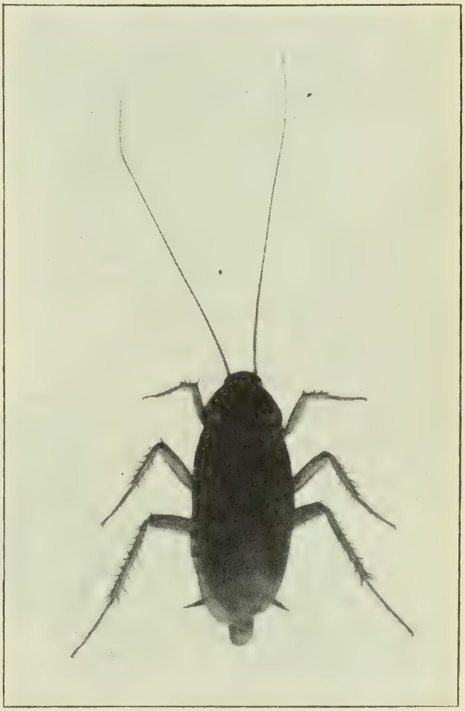
(*Ectobia germanica*)

Croton bug carrying egg capsule. Natural size

Appearance of the insect.— The croton bug is a light brown cockroach about five eighths of an inch in length. It has long antennæ, and long, slender legs with which it can run very fast. Its body is wide, but thin, so that it can creep into cracks and crevices where it hides during the day. The croton bug is most abundant in the pantry and the bathroom, about water pipes. It came to us from Europe.

Story of its life.— The mother cockroach lays her eggs in a mass enclosed in a sort of capsule, instead of one at a time as is the way of most insects. The eggs hatch, and the young roaches, which are soft and whitish, soon grow harder and darker. It takes these young roaches four and a half to six months to become full-grown. They shed their skins at least six times before they become mature.

Other cockroaches in the house. — The large American cockroach with very long, veined wings, and the black oriental cockroach—the female of which has very small wings or none at all—are often found in houses.



The American cockroach

Injury and control.— Cockroaches actually destroy much food in the pantry, and make much of it unfit to eat because of their filthy habits and the peculiar odor that they leave behind them whenever they are in abundance.

In fighting cockroaches, persistence should be the watchword. The insects are shy, apparently cautious regarding baits and poisons, and difficult to reach in any manner.

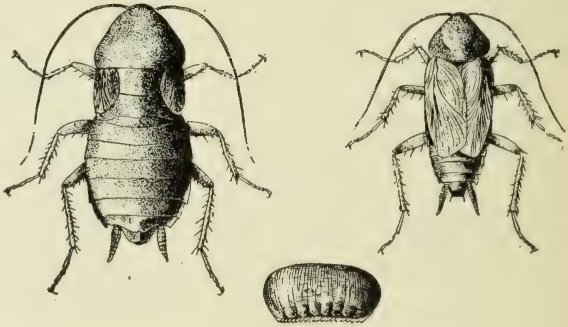
A simple device for trapping cockroaches. Much reduced

Various kinds of traps have been devised for catching roaches. The box with cone-shaped tubes, shown in the illustration, affords a sample of a modern trap. The box is baited at night with cheese or other favorite food. The roaches can enter but cannot escape.

A rather unique method of killing roaches is described by Mr. Tepper, of Australia. Plaster of paris, one part, is mixed in a saucer with flour, three or four parts, and placed where the insects are abundant. Near at hand is placed a flat dish containing water, with bridges so arranged that the roaches can easily reach it. They eat of the flour and the plaster of paris, and either are killed or leave the premises.

A powder known as insectoline, manufactured by the Insectoline Company, Chicago, Illinois, has given good results in fighting these insects. The writer has used it in kitchens and pantries with satisfactory results. In order to obtain the best results with this powder, it must be applied frequently and in large quantities.

Professor F. L. Washburn, after failure with several so-called remedies for cockroaches, tried powdered borax and has this to say concerning its value as an exterminator of roaches: " We then turned to powdered borax, using it freely in the kitchen with marked success. This was sprinkled in cracks about the sink, along the tops of baseboards, near the sink, and elsewhere, wherever there were cracks that afforded the insects a hiding place. By a generous use of this substance, persisted in for two weeks, the room, in fact we may say the premises, were entirely freed from this disgusting pest."

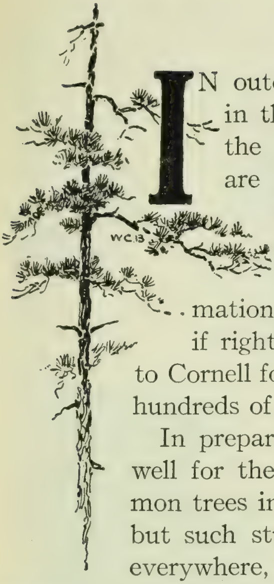


Oriental cockroaches, male and female

Whatever powder or substance is used, it must be applied in large quantities and at short intervals for an extended period of time.

TREE STUDY

The Editors



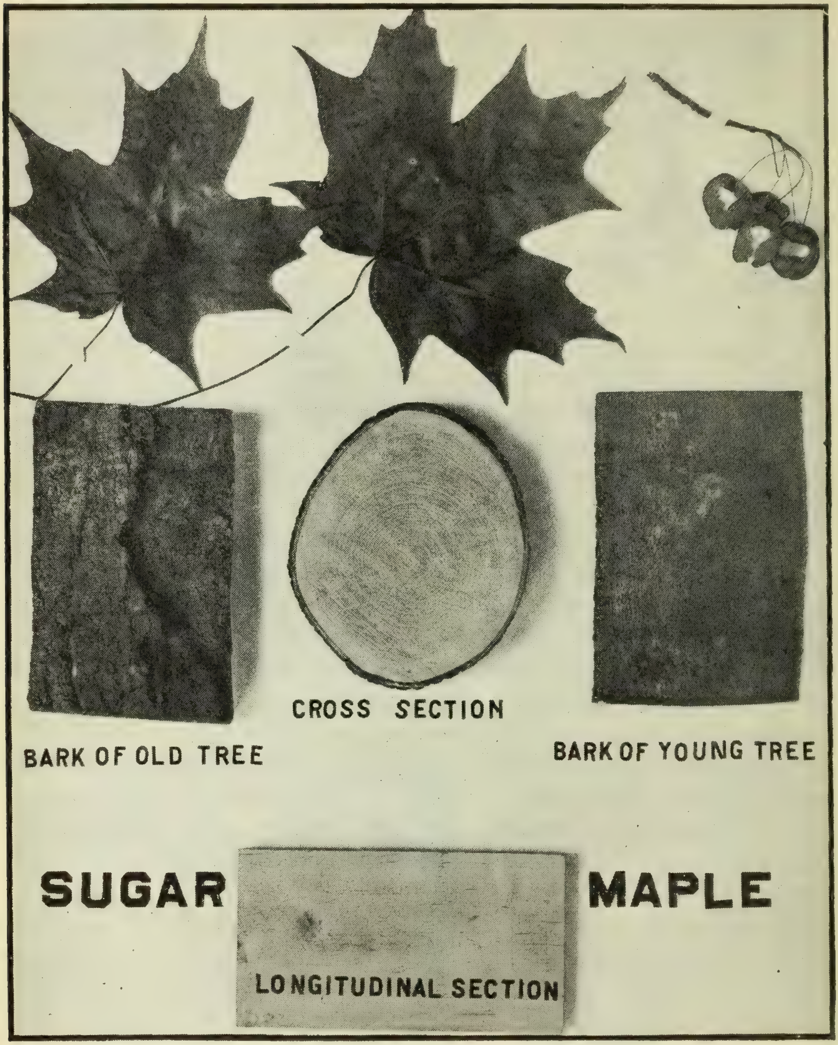
IN outdoor study there is always a permanent interest in the trees. Children should be taught to know the common species and to care for them. We are giving definite instructions for preparing an exhibition of school work relating to the trees for study in 1914–1915. This work will encourage the children to go to nature for information, and it is surprising how much they will do if rightly started. If they plan to send their exhibitions to Cornell for Farmers' Week, entering them with others from hundreds of schools, it will give impetus to their efforts.

In preparation for the lessons for this year it would be well for the teacher to try to become familiar with the common trees in the locality. Sometimes this may look difficult, but such study is worth the time spent on it. Trees are everywhere, and present new phases with the changing seasons. If the teacher has not the background to make a beginning in this study, she should find some one in the neighborhood who does know the trees, and we feel safe in saying that there is hardly a country district in New York State in which there is not at least one person who has a fairly good knowledge of the different species in the country round. Then, too, if any tree cannot be identified locally, specimens of leaves and twigs may be sent for identification to the New York State College of Agriculture. Gradually the knowledge of the teacher will increase, and the children will help, for usually boys and girls become interested in all that interests their teacher.

If plans are made to have an exhibition in the school this year, or to send one to the State College, it should not be large. One simple piece of work will make a good beginning. Let the children prepare a mount of all the different specimens that can be obtained from a maple: twig, leaves, a cross section of wood, a longitudinal section of wood, a piece of bark, flowers, and fruit. Perhaps when this exhibit is completed they will be glad to prepare another of a different species; but the first is important, and the simplest beginning is always the safest. For collecting the specimens, Professor Frank B. Moody, of the Department of Forestry, makes the following suggestions:

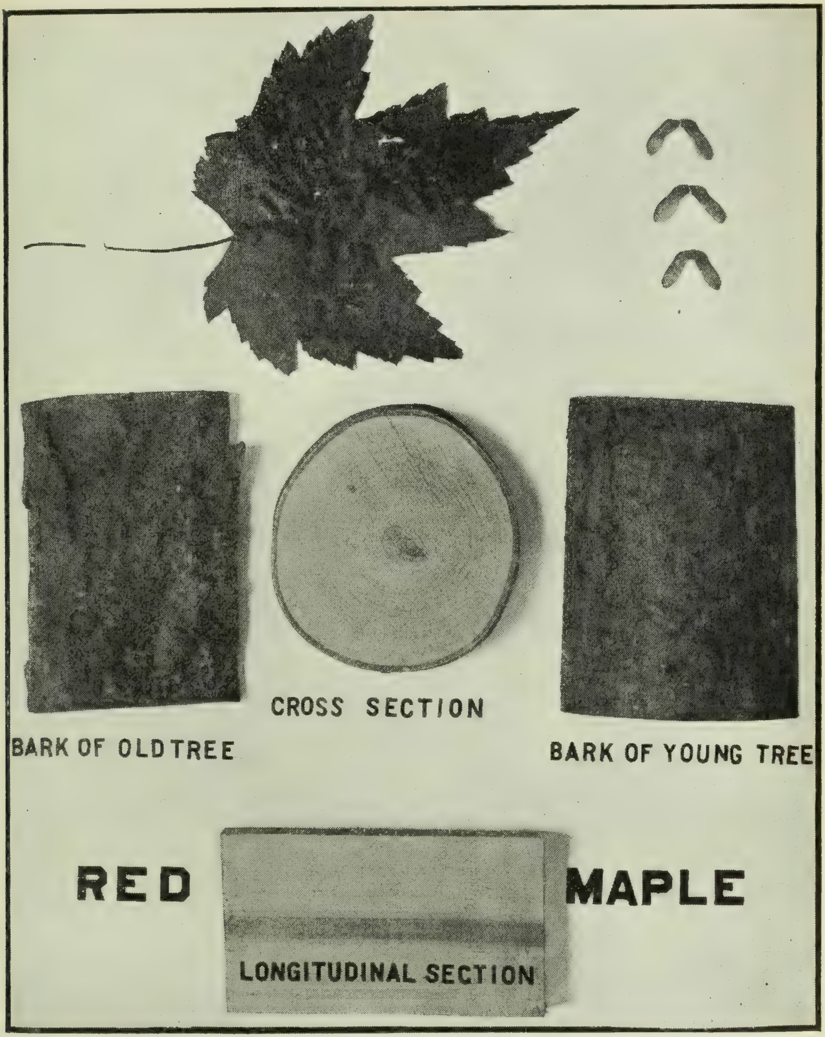
How to collect, prepare, and mount specimens

"Specimens of wood, bark, fruit, and leaves can usually be collected by the boys in a near-by woodlot from which the winter's supply of fuel is being cut. In no case should the trees be cut down for the purpose of securing specimens for an exhibit. Pupils must always remember that it takes twenty to forty years to grow a tree six inches in diameter, and that it takes only five minutes, perhaps, to destroy it. We should practice forest preservation and not forest destruction.



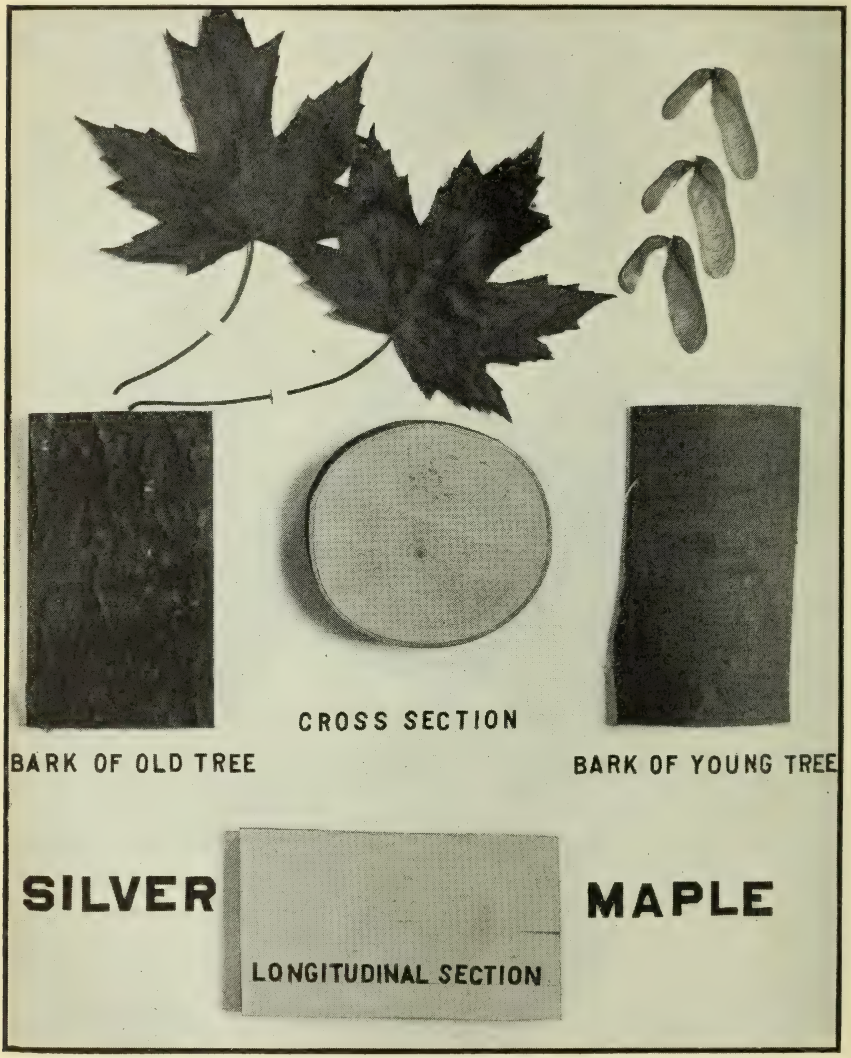
Specimen mount of sugar maple

" The specimens for the illustrations were collected in the university woodlots which have been placed under the management of the Forestry Department. The rough bark was in every case taken from the stumps of trees that had been cut last winter, while the smooth-bark specimens were cut from the branches and show very clearly the difference in the bark of the trunk and the limbs of a single tree. These specimens were cut four and one half inches long, and about three inches wide by three fourths of an inch thick. The longitudinal section can be smoothed off



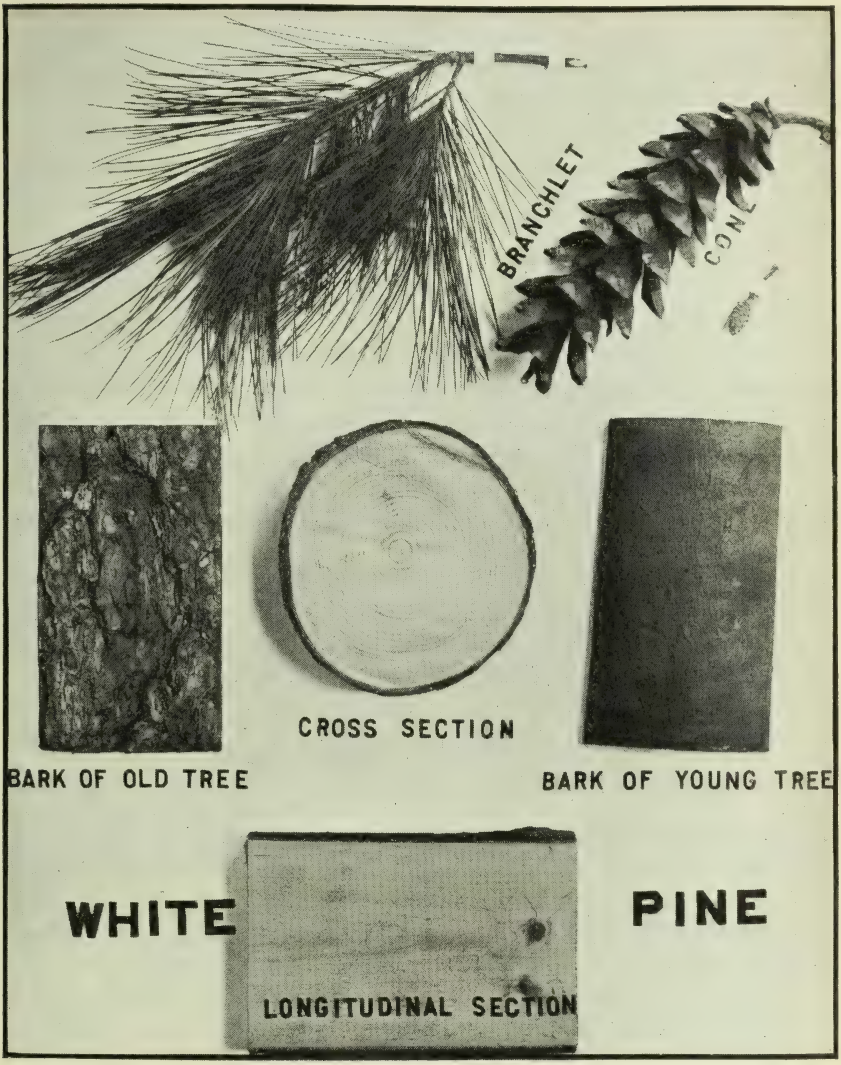
Specimen mount of red maple

with a plane or a drawshave. The cross section, which will show the annual rings of growth as well as the presence or absence of heartwood, should be about three fourths of an inch thick and three or four inches in diameter. Since the seeds of red and silver maple mature and fall in May and June, they must be collected at that season of the year, while the seeds of all the other maples mature in the fall and can be collected in August or September.



Specimen mount of silver maple

" The wood specimens in the illustrations were tacked to the cardboard with No. 8 cut tacks, while the leaves and seed of the maples were fastened with stickers and glue. Attention is called to the two pine cones in the white pine mount. It takes two years for the white pine cone to mature, and the small cone shows the average size of cones at the end of the first season. The mature cone was secured to the cardboard by running a twine string around either end of the cone and through the cardboard.



Specimen mount of white pine

"In order to show the marked difference in the appearance of the bark of young and old growth, it is suggested that specimens be collected, showing these differences, and that they be mounted side by side as shown in the picture. For the schoolroom collection, the specimens can be mounted on ordinary cardboard and hung from a nail through the top, in the schoolroom or cabinet. The specimens are to be used, and should be fastened to the cardboard as above mentioned. The size of the cardboard mounts should be 10 x 12 inches."

A field trip.— Much interest in tree study may be aroused in preparation for a field trip. The children can make some investigation of woodland in the neighborhood and report on the same. How many woodlots are there in the district? What is the commonest tree in each? Are any farmers planting trees for the woodlot of the future? The value of wood at the present time should be discussed; the importance of wood on the farm for fuel, posts, and repairs. Boys and girls should be taught how important it is for farmers to consider the planting of trees, and that they can obtain expert advice as to what to plant and how to plant by writing to the College of Agriculture or to the United States Department of Agriculture.

On the following pages some lessons are given that will be helpful in the study of trees for this year.

Caution: In obtaining specimens for collections children should always be taught to respect property rights and to conserve valuable or rare species. This is especially true in the tree work. Wait until opportunities of getting desired specimens arise naturally on some of the woodlots in the community, and have the boys and girls ready to take advantage of these occasions.

FORESTRY IN THE RURAL SCHOOLS

FRANK B. MOODY

In the new educational movement to have children in the rural districts taught in terms of their daily life, agriculture, domestic science, and other practical subjects are being introduced into school work. Some educators who are deeply interested in having boys and girls take an interest in all phases of agriculture consider that a little forestry, such as the care of the woods, might have a place; that side by side with instruction in the care of the orchard and of the shade trees about buildings and along highways, the raising of a useful crop of wood might give opportunity for educational work.

Forestry experience teaches us the following principles:

1. Certain phases of forestry, such as the planting and care of the woods, are a real part of agriculture, since they have to do with raising a crop from the land. The methods are simple, and the results are even more certain than those of other lines of agriculture. Forestry can make

the land profitable. It is especially suited to our country, in so far as it is developed with less labor and can make a larger income from poor lands — such as a rough and mountainous country — than any other form of farming; and it has served in Europe to prevent millions of acres from becoming useless, barren waste.

2. Forestry helps to regulate the distribution of water and lessen the rigors of climate, and in so doing it aids all forms of agriculture. It cares for nature's greatest means for beautifying the earth.

3. It provides a local supply of timber and protects the farmer and the townsman against exorbitant prices of importation; it stimulates local industries, and thus creates a local market for produce.

4. It is not a new and untried industry, but has been in actual practice for more than a thousand years and has not failed in any locality.

5. It is of particular interest to farmers, since it adds to the value and beauty of the farm and to the safety, comfort, and income of the farmer; and it does all this without great expenditure of capital or labor.

6. It is well suited to state, county, and township ownership and enterprise, and could well be utilized in our State, as it is in the Old World, to maintain larger tracts of inferior lands in useful condition and at the same time lessen the tax burden in the very locality where the taxes weigh heavily.

To sum up, then, the forest is needed everywhere because we must be supplied with wood and timber; it makes the best crop on all rough and poor lands; it regulates water distribution and local climate; and it beautifies our land. The question now comes, What can the rural school do in forestry? This question has not yet been answered, nor will it be until much thought and experiment have developed good pedagogy of forestry. All teachers in rural schools can help in this, and we hope that some useful and interesting work will result this year. The following are a few suggestions:

1. Help the children to organize what they already know of trees and woods, and by demonstrations help them to knowledge that will be more definite and exact. Most farm boys know an oak from an elm, but the knowledge is not clear, exact, and reliable as it may be. A few questions, and a simple comparison of leaf, fruit, and the like, will make a good beginning in this work.

2. The boys and girls should be encouraged to talk about the woods — where they are, to whom they belong, how large they are, what is being done with them. The children will begin to see the woodlot in a new light. They will realize that some one cares about the trees, and they will bring to the schoolroom not only specimens, but also observations and information.

3. The economic interest in forestry may be stimulated by some sug-

gestions such as the following: How logs are taken to mill; to workshop; the value of this to the farmer and to men in mill and workshop; how the workers spend their money to buy produce, hay and feed, provisions for their homes, and the like. Let the pupils follow up these considerations to a discussion of big markets, transportation, and general manufacture, and lead them to see what timber and the products of the woods mean to people.

Help the boys and girls to realize how the forest influences rainfall; the springs and rivers; how it keeps the land from gullying and washing; how it breaks the force of cold and drying winds, and therefore helps the farm crops; also develop an appreciation of trees and shrubs and woods as the great decorative feature in the landscape.

The economic losses due to waste land will be of value in discussions of forestry. Any farm boy or girl readily appreciates that there is loss every time an acre of land is allowed to lie unused during a growing season, and that this loss is real, immediate, and irredeemable, and may be measured by the value of the crop that the land could grow. The amount of this loss in the vicinity and township leads up to a few figures regarding the county and State, and brings home the importance of this subject.

4. In many ways the teacher can help the pupils to realize the pleasure that comes to us from trees and woods — the shade and shelter about the house and on the highway, the place for camping, berrying, and nutting, for finding wild flowers, birds, squirrels, rabbits, and other interesting animal life, for fishing and other outdoor experiences. The children may also be taught that it is our duty to try to keep our farm, and our township and county, as beautiful and homelike as possible, and that the trees help in this.

5. The pupils should be encouraged to gather tree seeds, to plant forest and shade trees and shrubs, and to trim, thin, and protect them; these processes are all so intimately connected with farm work that very little teaching, in the ordinary sense, is required. Every farm boy of twelve knows how and where to gather a few nuts, acorns, seeds of maple, ash, and the like. He also knows how to sow or plant seeds, and how to place a small tree so that it will grow. He may be taught that with a spacing of four by four feet these trees, before long, will suffer if left alone; that they will crowd one another, and pinch and cripple their crowns; that the weaker will die off; and that it is better to thin such a thicket rather than to leave too many trees to injure one another and retard the growth of the entire stand.

The matter of protection of trees is important. The children know that trees suffer if mutilated, and that a forest fire is always serious. When children learn from teacher and parents about the value of the woodlot, they will not be so likely to commit vandalism in the woods.

THE MAPLES OF NEW YORK

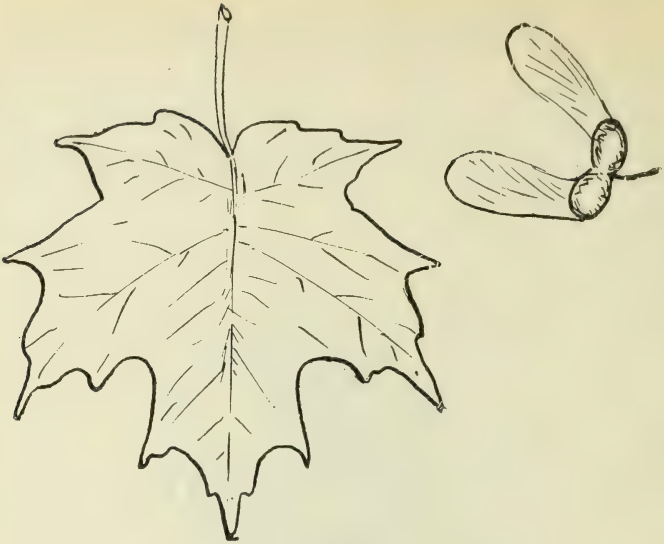
John Bentley, Jr.

The maple family is a large one, containing many trees that are not only useful but also ornamental. In fact, most of the maples are valued chiefly because of their beauty of foliage. About thirteen kinds are considered native to the United States, but by far the greatest number of the maples are native to Asia and the islands bordering that continent. Many of these foreign maples—some of them trees, and some shrubs—have been planted in this country and are common in parks and gardens or along city streets; so that, whether we are in the country or in the city, we are almost sure to see maple trees. Maples are noticeable chiefly, perhaps, because of their foliage. Whether we consider the individual leaves of a silver maple or the whole mass of foliage as it appears on a large sugar maple, the leaves are beautiful. The little, tender leaves of the soft, or red, maple, when they burst from the buds in April, are rich and warm in coloring; and what boy or girl who has been in the country during the month of October does not know the brilliant colors for which the maples are famous then? The reds, golds, and yellows seem to flood the autumn air with a warmth and light which adds life to it.

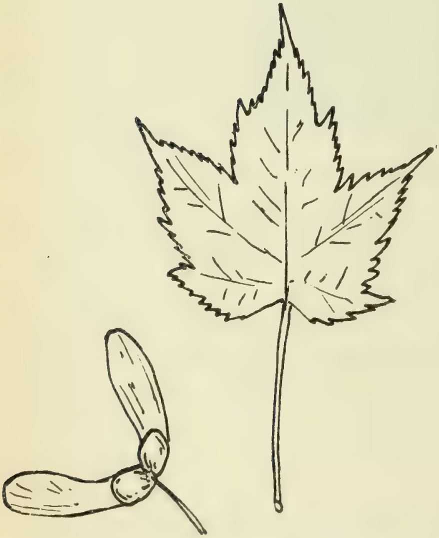
Sugar maple

Let us make a list of the maples that we may expect to find in New York State, and then add a few descriptive notes regarding them:

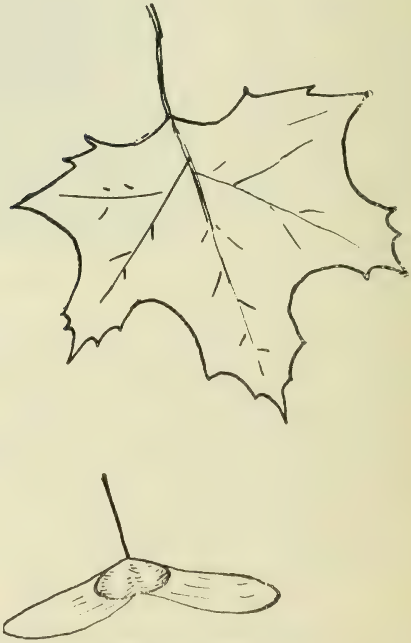
1. Sugar, or hard, maple
2. Red, or soft, maple
3. Silver maple
4. Mountain maple (a shrub)
5. Moosewood, or striped maple (a shrub or small tree)
6. Box elder, or ash-leaved maple
7. Norway maple (not native, but commonly planted)
8. Sycamore maple (imported)



Sugar maple

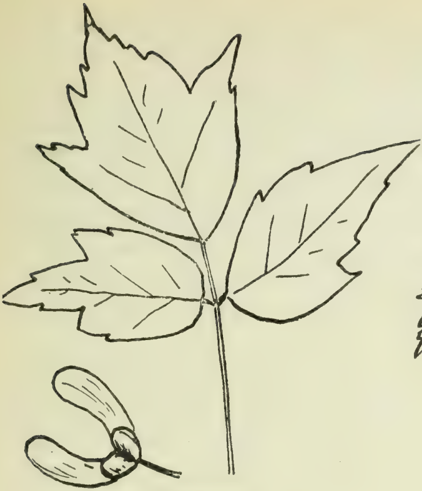


Red maple

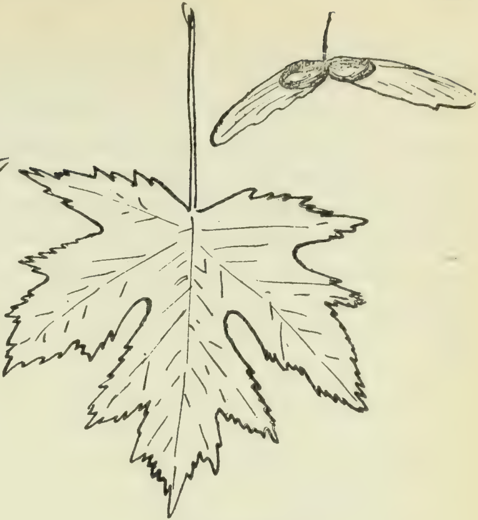


Norway maple

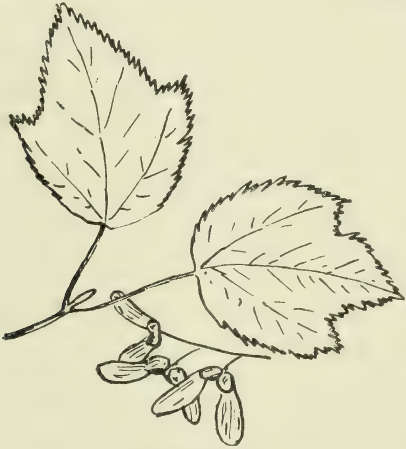
Outline drawings for blackboard work



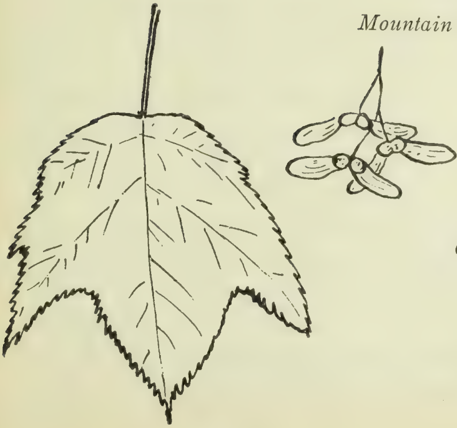
Box elder



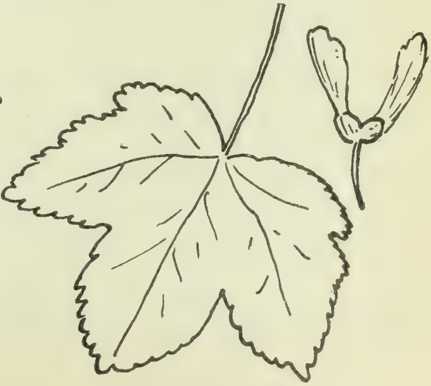
Silver maple



Mountain maple



Moosewood



Sycamore maple

Outline drawings for blackboard work

The sugar maple is the largest and finest of the family. In deep woods, where it grows with the beech, birch, basswood, hemlock, ash, and other trees, it often reaches a height of more than one hundred feet, and has a trunk perhaps four feet in diameter which rises straight and full without a limb for more than half the height of the tree. Such a tree is in great contrast to those growing along the roadside, which are shorter and large-crowned and which have so many branches that it is difficult to find any one stem that seems to be the leader. Why does the maple tree growing in the open, where it has plenty of room, form such a round-headed crown, with no well-defined leader? Study the method of branching and see whether you can find out.

The red maple can be distinguished from the sugar maple by its leaves in summer and by its buds in winter. The two kinds are contrasted in the drawings. Note that the lobes of the leaves (of which three are usually very conspicuous) are separated by U-shaped depressions, or sinuses, in the case of the sugar maple, and by V-shaped sinuses in the red maple. The buds of the sugar maple are long, pointed, and of a brown color, while those of the red maple are shorter, rounded, and red in color. These marks will serve as a means of identification at any time of the year. The red maple prefers a wet, swampy soil, while the hard, or sugar, maple thrives in a rich, cool, well-drained soil.

The silver maple has a very beautiful leaf, by which it can always be recognized in summer. Notice, in the drawing, how deeply and finely the leaves are cut; this gives to the tree its peculiar delicacy and makes it desirable for decorative purposes. In fact, the tree is of little use except as an ornament; the wood is soft, weak, and brittle when compared with that of the sugar maple.

The mountain maple and the moosewood (or striped maple) are very humble members of the maple family, rarely growing to be more than shrubs; but they add greatly to the beauty of the woods as we know them in the North. Both these maples are common in the woods of New York, especially in the Catskills, the Adirondacks, and other hilly parts of the State. Favorite situations for these maples are steep, rocky slopes where there is plenty of moisture, as on the north side of hills or mountains. The leaves are much like the leaves of other maple trees; those of the mountain maple resemble those of the red maple, but the little veins on the former are much more noticeable and the underside of the leaf is covered with a whitish down, which is absent from the red maple. Another character that will serve to distinguish this little maple from the red maple is the seed. The flowers of the mountain maple appear in clusters, which botanists call racemes; that is, there are several flowers borne on a central axis, and they begin to blossom at the bottom first.

The artist has come to our assistance again, and you will see in the drawing of the seeds that the difference in the fruit is clearly brought out. The red maple bears its seeds in clusters close to the stem.

The moosewood has a leaf that distinguishes it easily from other maples. The leaf is large, with lobes only slightly cut, and is soft in texture. Perhaps the most noticeable character of this tree — one by which the boys will learn to recognize it — is the bark. This is reddish or greenish brown marked with pale stripes running up and down, so that the name "striped maple" is very appropriate. The flowers of this maple also are borne in racemes, so that this feature, together with the striped bark, will always serve to identify it.

The box elder, or ash-leaved maple, is the odd member of the family, for it has leaves totally different from those of the other maples that we know in this country. Instead of a single, simple leaf, this maple has a compound leaf with three to five leaflets. If it were not for the fruit, which is a true maple key, we should feel more inclined to call it an ash — a feeling that is shown in one of the common names for the tree. The box elder has been used for planting in the treeless regions of the Middle West because it will endure dry weather and will grow rapidly even on relatively poor soils. But the wood is weak and perishable and the tree almost always grows crooked, especially if it is exposed to winds; so that altogether it is not to be considered very valuable.

The Norway maple, which has been planted extensively as a shade tree because of its rapid growth and heavy foliage, is a native of Europe but does very well in this climate. The leaves bear a general resemblance to those of the hard maple, but are much darker in color, usually larger, and thicker. If one is in doubt about the tree, the milky sap from a freshly broken leaf stem will distinguish it. In winter the leaf buds are very large and the bark is smooth and dark-colored.

The sycamore maple, another European tree, is also planted to some extent in this country although it does not grow so well in our climate as does the Norway maple. The leaves are conspicuously three-lobed, and are very broad compared with those of the native hard maple. The margins of the leaves are serrated, somewhat like those of the red maple.

The most valuable and useful of all the maples is the sugar maple. The wood is heavy, hard, and close-grained. It is used for furniture, flooring, and many small wooden articles. It also makes one of the best firewoods that our forests produce. The custom of making sugar and sirup from the sap of this tree is well known and needs no special mention here.

Besides the maples mentioned above, it is likely that many Japanese maples will be found in parks and gardens. These small maples, rarely larger than bushes, are remarkable for the beauty of their leaves.

THE PINES OF NEW YORK

JOHN BENTLEY, JR.

In the winter months, when most of our forest trees are leafless, the firs, spruces, and pines, with their dark green foliage, are a cheerful sight. It makes us feel, somehow, that after all the woods are not lifeless in winter, and that there are some trees bold and hardy enough to withstand the snow and the cold. Pines are particularly noticeable, because there is more motion and life in their foliage than in the stiff, rigid foliage of spruces and firs. Then, too, pines are more familiar to most of the boys and girls in the State, because spruces and firs belong to the cold climate of the mountains.

White pine

There are five pines that are native to New York State, besides several others that may be found occasionally in our parks. The five native trees are (1) the white pine, (2) the pitch pine, (3) the red, or Norway, pine, (4) the jack pine, and (5) the Jersey scrub pine. The last two are not very common, however, and most of us will find only the three first mentioned.

The pines as a group are marked by three characteristics which all boys and girls should notice first of all. They are: (1) the needle-shaped leaves, borne in clusters of two, three, or five needles; (2) the cones, in which the little seeds are borne; and (3) the wood, which always contains more or less pitch, or resin. These characters distinguish the coniferous (cone-bearing) trees from the broad-leaved trees. The term "evergreen" should not be applied to the pines, spruces, and firs, because there are other trees, as the holly and the live oak, which retain their leaves throughout the winter and are just as truly evergreen as is the pine or the spruce.

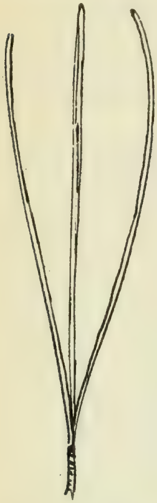
Then there is the larch, about which we learned two years ago (Rural School Leaflet for September, 1912, page 160), which bears cones and yet sheds its leaves every year. The leaves of the larch are needle-shaped, it bears cones, and there is some resin in the wood, and therefore it clearly belongs to the same family as do pines, firs, spruces, and hemlocks. In order to avoid all confusion, therefore, I would suggest that we learn to call all cone-bearing trees conifers, which means "cone-bearers." Then let us call the others broadleaf trees; this will properly include the live oaks and the holly, and will do away with the confusing term "deciduous" (leaf-shedding) trees. Another term that is frequently heard is "hardwoods." As generally used, this term means the broadleaf trees, although there are some conifers with very hard wood — yellow pine, for example — and some "hardwoods," or "broadleaf" trees, with very soft wood, such as the poplar and the willow. The use of confusing terms should be abandoned and the terms "conifer" and "broadleaf," while sounding a little strange at first, will express our meaning more closely.

The pines are nearly all of great value because of their wood, which is strong for its weight, straight-grained, and easily worked — that is, carpenters have little difficulty in planing and shaping it to their purposes. Some of the pines have very hard, heavy, resinous wood, as the Southern yellow pine; but our Northern white pine is light and soft and contains only a moderate amount of resin. The white pine was formerly the most important timber tree of all the Northeastern States, and many millions of board feet of white pine have been cut from the forests of New York State within the past century. It is still considered a very valuable tree, and lumbermen are always glad when they can find any white pine to cut because they know that it will bring a good price in the markets.

White pine needle cluster

The white pine is a tall, straight-trunked tree, often reaching a height of one hundred and twenty-five feet in the dense forests of the Adirondack Mountains. When growing in the woods the trunk is frequently clear of all branches for sixty or seventy feet, but when grown in the open, where it has plenty of room, the crown is broad, with many limbs growing to within fifteen or twenty feet of the ground, and under these conditions the tree never grows very tall. The lumberman likes best of all the tall, straight trees of the forests, for these will yield fine, straight-grained lumber with few knots.

The white pine can be distinguished from the other pines of this State by the needles, which grow *in clusters of five*. Examine the foliage of a pine tree; you will see that the needles, instead of growing singly, grow in bunches, or clusters. In the white pine there are always five needles in a cluster. The individual needles are two and one half to five inches long, slender, flexible, bluish green, with a fine white streak. Let us now look for some cones. We may find some growing on the tree, or we can examine those that have fallen from the tree and are now lying on the ground. The white pine cone is about five inches in length, is usually slightly curved, and is slender, rarely exceeding an inch in thickness. Let us look a little more closely and see whether there are any spines, or prickles, on the cone. If we have picked up a dry cone the seeds have doubtless been shed and scattered. If we can find a fresh cone with seeds in it, we can see how each seed is provided with a thin wing, which enables the wind to blow it for long distances.



Pitch pine needle cluster

Now let us consider the pitch pine, which is probably the second commonest pine tree of this State. It is generally found growing on very poor soils, where only the hardiest trees or shrubs will thrive. This tree can grow in these poor situations because of its thick bark (which is often two inches thick at the base of the tree) and because it can resist fire much better than can the white pine. It is not nearly so neat in appearance as the white pine; its branches are irregular, the trunk is not so tall and straight, and the old cones frequently hang on the tree for years. The foliage is stiff and the needles are borne in clusters of *three;* this at once distinguishes it from the white pine. The needles are a dark yellow-green instead of a blue-green. The cones are short and stout, about two or three inches long and two inches thick, and the cone-scales are armed

Pitch pine

with prickles. There is not the slightest resemblance between the white pine and the pitch pine, in either needles, cones, or bark; and if you have an opportunity to look at the wood after the tree has been cut, you will find that there is no more resemblance there. The wood of the pitch pine is coarse-grained, full of pitch, and not adapted to the fine work for which white pine is used. Indeed, the wood of pitch pine is of little value except for coarse, rough lumber and for excelsior.

The red pine, or Norway pine as it is frequently called, is a tree that is not found in many parts of this State. It is common only in the Adirondack region, where it grows on light, sandy soils and has plenty of sunlight. It may be found occasionally, however, in other parts of northern New York. It can be distinguished by its *long, flexible needles* (four to six inches long), which are borne *two in a cluster*. The cones are two to two and one half inches long and *have no prickles*. Taking the cones and the needles together, there is no danger of confusing this tree with the other two pines mentioned.

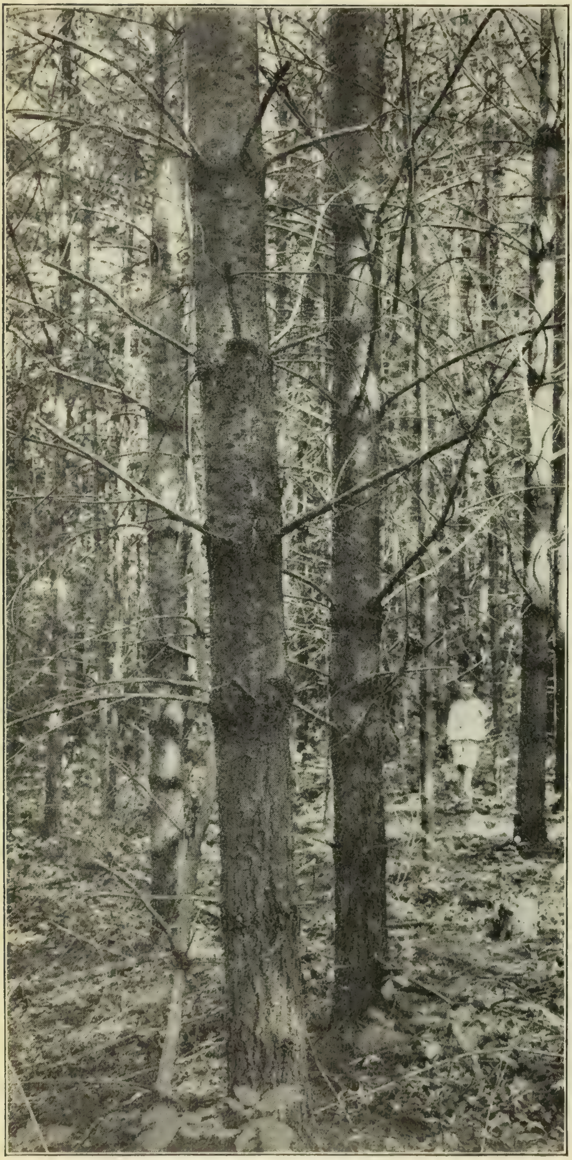
The red pine reaches a height of seventy-five or eighty feet. The wood is harder than that of the white pine, yet, like white pine, it is not durable in contact with the soil. Because of its hardness it is not so valuable a timber as white pine, but the red pine possesses the great advantage of being a tree that will grow well on land too poor to produce a satisfactory crop of white pine. It rarely makes close forests, because it is a tree that demands a great amount of light for its growth. Red pine trees are never found in large numbers together, at least in this State, but are found mixed with other trees, especially at the edge of lakes or in openings throughout the sandy stretches of country that are common in the Adirondack Mountains.

The jack, or scrub, pine is not frequently seen in this State except in dry, sandy, barren soils in the northern part. It is usually a small, scrubby tree, with irregular branches, and of such poor form that it is practically worthless for lumber. The leaves are bluish green, covered with a gray bloom, and about two inches in length. They are borne in clusters of *two*, are twisted, and have a tendency to spread apart. The cones are small (rarely more than two inches long) and are armed with small prickles, which, however, may drop off.

The Jersey scrub pine is still more irregular and worthless as a lumber-producing tree. It grows in poor, sandy soil and is found growing wild only on Long Island. The needles are borne in clusters of *two* and the cones have prickles.

THE WHITE PINE

WALTER MULFORD



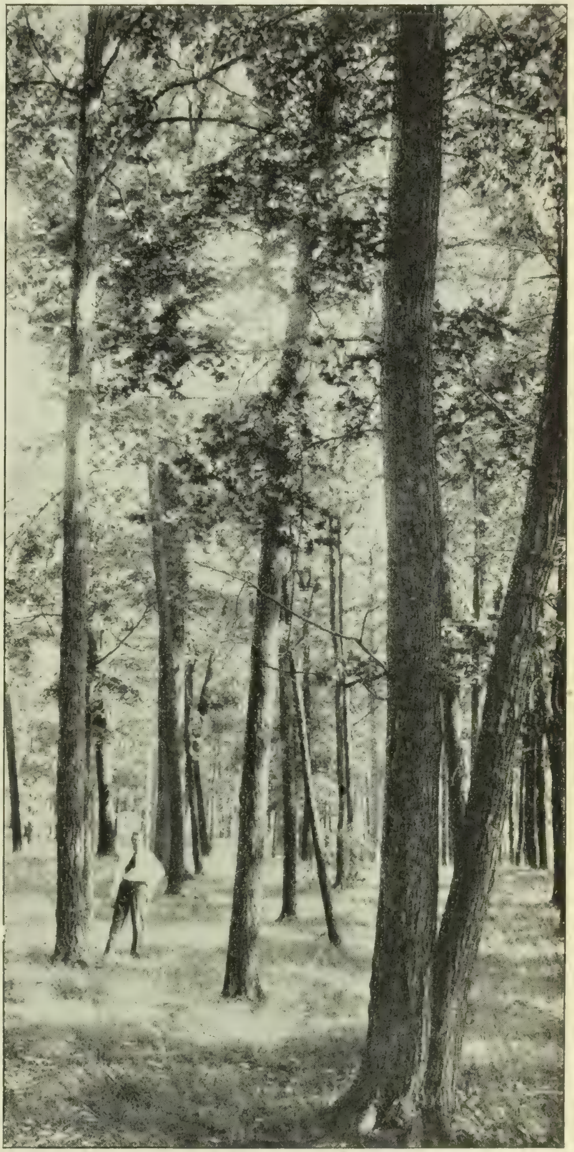
A carpet of leaves and other litter helps the forest

There are about six hundred species of forest trees native to the United States. These trees may be divided into two general classes, broadleaf trees and conifers — the latter having needle-shaped, scale-like, or linear leaves. There are less than one hundred species of conifers, yet they are much more useful than the broadleaf, or "hardwood," trees. The wood of most of the conifers is soft and easily worked, and is therefore adapted to more important uses than that of the hardwoods.

The conifers furnish a large proportion of all the timber used in the United States, and half a dozen species, growing in various parts of the country, furnish most of the coniferous timber. In the northeastern quarter of the United States the white pine has furnished more lumber than any other tree. In fact, we owe much to this tree for its aid to man in developing this part of the country.

Forest trees are more useful to mankind when growing together in numbers than when isolated as individuals. Let us, therefore, trace the life story of a clump of pines rather than that of a single tree.

From what does the grove of pines come? Our hardwood trees can start either from seed or by sprouts from the stump or root. The white pine, however, starts only from seed. If you will watch the pine trees, you will often find them bearing cones. These cones are not the seeds, any more than an apple is a seed; but in each cone, as in each apple, there are many seeds. If you will cut open one of the large cones in the latter part of summer, you will find two seeds under each cone scale. Two years are required for the cone to grow and the seeds to ripen. In September of the second year, the cone turns brown, the scales begin to open, and the seeds gradually fall out. As the seed is light and has a wing, it may blow for a long distance before reaching the ground. Seed is scattered rather thickly for a distance of one to several hundred feet from the mother trees.



A carpet of grass harms the forest

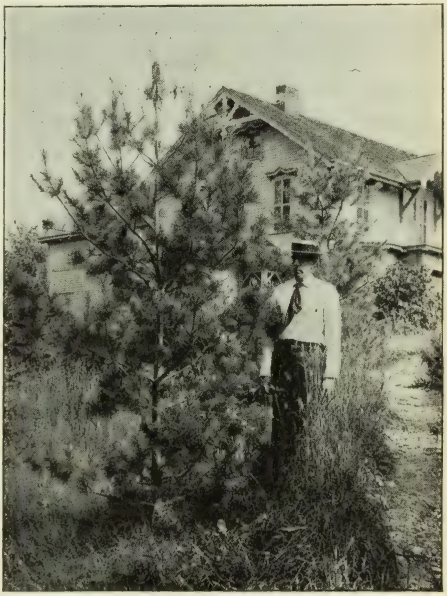
Only a small proportion of the seeds germinate when left to nature's care. There are many reasons for this. In some sections, squirrels cut large quantities of cones from the trees as soon as the seeds are ripe and before the scales have opened, and store them where they can get them as winter food. Sometimes several bushels of cones are stored in one hoard. Even if the seed escapes the squirrels, it is by no means sure to germinate. Much of it is infertile. Birds eat large quantities of it. The slightest fire will destroy it. It may decay or it may die from drought. The seeds that escape these and other dangers should germinate in the spring after ripening.

The pine tree grows only about two inches during the first year, and its roots enter the ground for but a short distance. It is therefore easily injured and there is a high death rate among the first-year seedlings: drought, fire, or disease may kill them; birds and mice destroy seedlings as well as seeds; cattle may trample them; they have to compete for water and light with grass and weeds, which may choke them out; in the winter, frost may force them almost entirely out of the ground, so that they soon die. During their second year the trees are still exposed to many dangers, and there is still further mortality. At the end of the second year, the trees that have survived will be four to six inches tall.

Since so few trees are derived from a very large number of seeds when nature does the sowing, the forester often resorts to sowing the seed in a garden or a nursery. By taking care of the trees there until they are two or three years old, he secures a very high proportion of trees from the seeds used. If he is to do this, he gathers the cones after the seeds are ripe and before the scales have opened, keeps them in a dry place until the scales open, works them over so that the seed falls out, and cleans the seed of the dirt and wings (as by a fanning mill or by working the seed through a sieve). The seed is then hung in bags in a cool, dry place and sown in the nursery in the following spring. Here the seedlings are given the best of care for two or three years, or sometimes longer. Finally they are set out as a forest plantation.

As the tree becomes a little older, it grows more rapidly in height. If you will examine young white pine trees, you will find that there are successive circles (called whorls) of branches. The distance between two successive whorls is one year's growth. As the tree becomes older, more or less of the branches making up the whorls die and drop off, so that the whorls become difficult to distinguish. But when the tree is young, the whorls usually make it possible to tell the approximate age and the amount of height-growth each year. This cannot be done with the broadleaf trees, such as oak and hickory.

After a few years, the tree may grow two feet, or even three feet, each year instead of two or three inches. In its first years the dangers that the little tree had to meet were from other kinds of plants and animals and other outside influences. Soon after the rapid growth in height starts, the branches of neighboring trees will probably begin to interlock. Now comes a new and great danger to the tree, that which arises from the fact that it is contesting for the limited amount of light with others of its own kind. If a tree drops behind in the race, it will probably soon die. As a result of the struggle among themselves, the number of trees to the acre becomes rapidly less and less as the trees become older.



A white pine tree fifteen years old

Although the trees are now mutually harmful, they are also very helpful to one another. For example, they give one another protection against being thrown down by the wind. The fact that they are so closely crowded causes the lower branches to die because of lack of light, and this leaves the trunks more free of branches. This is desirable, because each branch that persists on the trunk shows as a knot when the tree is sawn into boards. The trees help one another also in keeping a good layer of leaves and other litter on the ground. This layer, which the forester calls the forest floor, is of great importance: it is effective in keeping the soil mellow; it returns large quantities of plant-food to the soil and is thereby an effective fertilizer; it tends to hold the rain and snow water and checks evaporation, thereby making more water available to the trees, and the amount of water in the soil is one of the greatest of the factors that determine the rate of growth of the timber.

The forest floor is something of which the forest has great need, and nature, if left to herself, generally keeps it in good condition. Let us be careful that we do not destroy her good work. There are at least two ways in which we are likely thoughtlessly to do this: one is by fire, and the other by allowing the woods to be too open, that is, allowing the trees to stand too far apart. Even if fire does not kill any of the trees, it may cause injury by lessening the rate of growth of the timber due to the destruction of the forest floor. Let us be as careful about allowing fires to get beyond control in the woods as in our houses. If the woods are too open, the forest floor is likely to disappear because sunlight makes it decay rapidly; and the wind will blow the leaves into heaps instead of letting them remain evenly scattered. This often happens after a severe thinning of a woodlot. In such an open wood, grass and weeds come in. Since these use a large amount of moisture, they rob the trees. Unless the ground is more valuable for pasture than for raising timber, grass is harmful in the woodlot.

When the tree is cut, you can learn from it how fast it has grown at different periods of its life, and at what times helpful or harmful influences affected it. This is revealed by the concentric rings that you will find on the stump or the end of a log. In our climate each of these, with occasional exceptions, represents one year's growth. By studying the annual rings, one can tell not only the age of the tree but the growth in diameter in any given year. If there has been a long series of dry summers or if insects have injured the tree for several years, it will probably show in narrower rings; on the other hand, if a tree has been growing under the shade of an older one and the older one dies or is cut, thus giving the smaller one a better opportunity, you may find the rings becoming much wider soon after the tree is released from shade. This is very noticeable in spruce timber.

SUGGESTIONS FOR STUDY

Gather some pine cones in September, before the scales have opened. Extract and care for the seeds in the manner already described. In March or April, sow the seeds thickly in a box of sand or light loam in the schoolhouse, covering with about one eighth inch of soil. The seeds should germinate in about three weeks. Notice that the first leaves of the pine tree are very different from those that come later. Notice also that the seed coats come up above ground. When these are sown outdoors, the seed coats attract the birds, which may bite off many of the young trees.

After becoming familiar with the appearance of the seedling, go to the woods or fields and see whether you can find any young white pines near older trees. Dig up a pine seedling carefully and notice the character of its own root system, as contrasted with the roots of a small oak or hickory.

How many seedlings come up on a square rod or on ten square rods? Can you make any estimate as to how many seeds nature sowed on that area (that is, how many seeds per cone, how many cones per tree, how many trees per square rod)? What proportion of the seeds have developed into trees?

What part of the crown of the tree bears the cones? Does the cone stay on the tree after the scales are open and the seeds gone? Can you find one-year-old and two-years-old cones and empty cones all on the same tree?

When nature does the sowing, do the trees come up equally thick everywhere, and in rows? Which looks better in the forest, the trees in rows or scattered irregularly?

A pine tree holds its leaves (needles) all through the year. Are the same leaves kept throughout the life of the tree? If not, can you tell for how many years a pine leaf lives?

Do the branches drop off as soon as they are dead? Would it be easy to knock the dead branches from the lower part of the trunk with a long pole, so as to get one log which would be free from knots?

Count the number of whorls of branches on a young pine and measure the distance between each two whorls. Make a diagram drawn to scale showing how fast the tree grew each year. This is conveniently done by drawing a line to represent the total height of the tree, and putting short cross-marks at the proper intervals to represent the position of each whorl. For example, if a tree is now ten years old and six feet high, a line six inches long could be drawn, each inch representing a foot. If the growth of the last season were eighteen inches, it would be represented by the last one and one half inch of the line, and this space could be labeled " 1914, tenth year."

How many branches are there in a whorl? Notice that there is a leader, or main stem, growing from the center of the last whorl. If this dies, one or more of the branches in the whorl will become leaders; if two or more of them develop into leaders, a fork in the tree is formed.

How many trees of a given size are growing on one square rod or on ten square rods?

Determine the age of a tree or a log by the annual rings. Have there been any noticeable changes in the rate of growth in diameter at different times in the life of the tree?

The pine-tree grew in the wood,
    Tapering, straight, and high;
Stately and proud it stood,
    Black-green against the sky.
Crowded so close, it sought the blue,
And ever upward it reached and grew.

From *Three Trees*.

SELECTED.

THE ELM

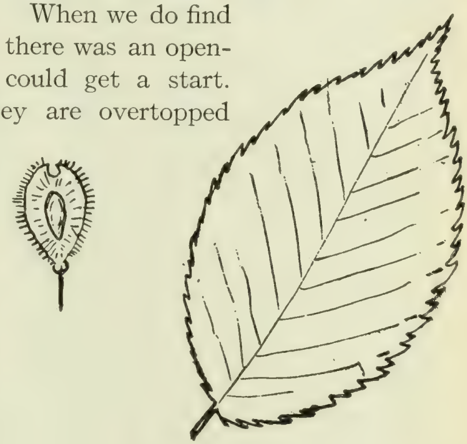
JOHN BENTLEY, JR.

Of the many trees that are common in New York State, the elm is doubtless the most familiar to boys and girls. The reason for this is plain, when we consider that the elm is a tree of the farms, the home lawns, and the streets of the towns, rather than a tree of the deep woods. While it is found occasionally in the forest, it is almost always scattered among other trees and never forms a large proportion of the forest, as do maples, birches, pines, or oaks. Throughout the New England States, New York, and Pennsylvania, the elm is one of the commonest shade trees, not only for the streets of the towns and villages but also for the grounds about the home. The tree is so graceful and beautiful, and, when old, so stately and dignified, that it well deserves the place which it holds in the estimation of the people.

The elm has a very distinctive form and habit of growth. Other trees seen from a distance are not always easy to recognize: the maple and the beech look somewhat alike, especially when young; the oak and the chestnut, the ash and the hickory, resemble each other slightly. But the elm, with its massive trunk — which quickly breaks up into several large branches, giving the tree an urn-shaped appearance — and the delicacy of the twigs and branchlets, forming a crown with a fringe-like margin, is easy to recognize even at some little distance. To a remarkable degree it combines strength with grace and beauty.

The elm is a widely distributed tree. It is found in southern Newfoundland and through the southern part of Canada as far west as the northern shore of Lake Superior. It grows along the Atlantic coast as far south as Florida, although it never reaches a very large size in the southern part of its range. Westward it is found from South Dakota to Texas, although not in such large numbers as in the East. Everywhere it shows a preference for the low, rich lands that border rivers and streams, and it grows to its largest size where the soil is rich, fertile, deep, and moist. Under favorable conditions it will grow to a height of one hundred and twenty feet and a diameter of eleven feet. Many very large trees have become famous, as the large elm at Lancaster, Massachusetts, and the two elms on the river bank at Wilkes-Barre, Pennsylvania. It is the wide spread of the branches, as well as the massive size of the trunk, which makes the elm impressive; sometimes the crown of a tree measures one hundred and twenty feet across.

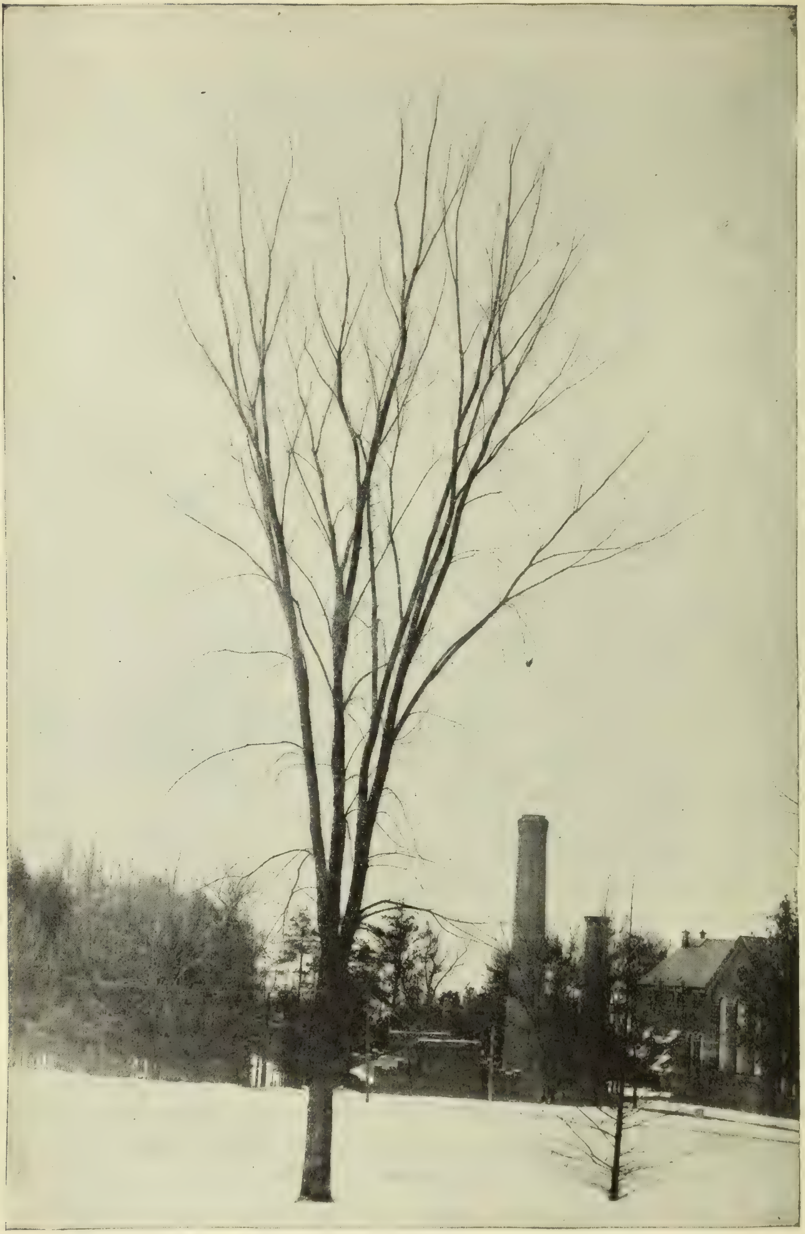
The elm tree, large as it is, springs from a very small seed. The flowers, which are inconspicuous, blossom early, before the leaves are fully grown, fade soon after blossoming, and are as quickly followed by the ripening seeds. These small seeds have wings on the margins, with sharp points, and are very short-lived. Unless they fall on soil that makes a good seed bed and germinate immediately, they will die. They cannot wait, as do the seeds of the hickory, pine, and many other familiar trees. (Can you think of another familiar tree that ripens its seeds in early summer?) Besides plenty of moisture, which is one thing that the little elm seedling must have at the start, the quality of the soil and the amount of light that comes to the seedling have great influence on its growth. The soil must be rich and mellow, so that the rootlets can penetrate easily and find plenty of food material, and there must be plenty of light, so that the seedling can grow rapidly and become able to take care of itself before the autumn frosts arrive. This demand for light is one reason why we do not find elm trees in the deep, dark woods. When we do find an elm in the forest, it is because there was an opening in which the little seedling could get a start. Elms will not do well when they are overtopped by their neighbors.



Elm fruit and leaf

When standing where there is plenty of room and light, the elm tree grows rather rapidly. Many men who do not consider themselves old can remember the time when, as boys, they watched their fathers set out elm trees along the roads or on the lawn, and those trees have now grown to be of large size. But the largest elms — those that are one hundred feet high and six to ten feet in diameter, with the large, spreading crowns — are probably two hundred years old or even older.

Whether the elm is more beautiful in summer or in winter it is difficult to say. In summer its dense foliage hangs in graceful sprays from the dropping branchlets at the ends of the long limbs, swaying in the breeze and making a delightful shade. The upper side of the leaf is dark green; the under side is grayish green, reflecting a soft light which is very pleasant. Stripped of its foliage the elm presents an appearance in winter which shows its strength — not the rugged strength of the oak, with its gnarled, irregular branches, but a supple strength suggestive of self-contained reserve force. It is in the winter, too, that the delicacy of the smaller branches is seen to best advantage. Every wind sways them but they do not break; they yield gracefully and seem to enjoy the blasts of winter.



American elm in winter

Unfortunately the elm is the prey of a tiny insect, which eats the leaves and threatens to destroy the tree entirely in some parts of the country. This little insect, known as the elm leaf-beetle, has damaged thousands and thousands of elm trees during the past few years; and although many persons have worked hard to get rid of it, the pest is continually spreading. The shade trees in towns and cities suffer most, apparently, and it is necessary to act promptly if the elm trees are to be saved. The insect itself is only about one quarter of an inch in length, brownish yellow in color, marked with a dark line along each side of its back. It sleeps during the winter, and the same warm days that bring out the elm leaves awaken this enemy of the elms. The beetles fly to the trees and begin to feed by eating small holes in the leaves. In a very few days the eggs are laid, and these quickly hatch into little grubs which begin in earnest to eat the leaves. So many eggs are laid that the number of grubs at work on the leaves is enormous. In fifteen or twenty days the grubs have completed their growth, and, unfortunately, their work of destruction also. They now crawl down the tree, and by the time another ten days have passed they emerge as fully grown beetles and are ready to repeat the process. Sometimes there are two complete broods of the insects in a single season, but the second brood as a rule does less damage than the first.

The only way to save the elms from this enemy is to spray the leaves with a poisonous liquid. Although the cost of spraying trees ranges from twenty cents to two dollars a tree, depending on number, size, and location of trees sprayed, yet it will be necessary to spray our elm trees systematically if we wish to save them. Those who are interested in the work of saving the elms should write to the State College of Agriculture and ask for a copy of Professor Herrick's Experiment Station Bulletin 333, entitled " Control of Two Elm-tree Pests."

The next time you are in the woods, see whether you can find any elm trees growing where the woods are thick. If you see any, notice the shape of their trunks and their crowns. Compare them with the trees that grow along the streets in town. What do you think makes this difference in form? Again, if you find any elm trees in the woods, notice the kind of soil in which they grow best. Is it wet or dry? What other kinds of trees are found growing with the elm?

About the last of May or the first of June, watch the elm to see when the seeds begin to fall. Take a few of them and sow them in a garden bed where the soil is soft, rich, and moist. Perhaps you will be able to see the small seedlings grow to a size that will enable them to take care of themselves before winter sets in.

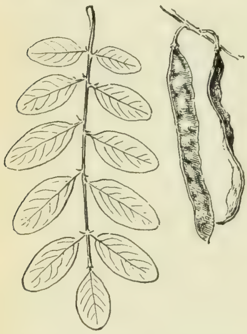
The wood of the elm is useful for purposes demanding great toughness.

It is often used in the making of barrels and fruit baskets. It is hard to split and work, and for that reason carpenters do not use it for woodwork or finishing; but if a tough wood is needed, a better wood than that of the elm is difficult to find.

THE LOCUST

John Bentley, Jr.

This year we have for study the *locust* tree, which is one of the broadleaf trees. We have learned that the cone-bearing trees furnish a very large proportion of the timber used in our country, and that the hardwoods, or broadleaf trees, are perhaps not so generally useful. For certain purposes, however, the carpenter or the builder frequently has to turn to the hardwoods for what he wants, either for hardness or durability or for the beautiful grain and satin-like finish of which hardwoods are capable. We all know that a handsome piece of mahogany or curly birch or bird's-eye maple is much better suited to the making of fine furniture and the interior finishing of a house than is spruce or pine. Each class of trees has its own uses: the pines, spruces, and firs are especially useful in construction work and framework, for which such qualities as strength, medium weight, and durability are required; the hardwoods are chosen for finishing and trimming, as well as for furniture and cabinet-making, for which beauty and elegance are wanted in addition to strength.



Leaf and fruit of common locust

Unfortunately, not all hardwoods are equally attractive, even when carefully worked and smoothly polished. In order to be handsome and useful for furniture or interior finish, a wood must possess a certain degree of hardness so that it will take a fine polish; and in addition to this, it should have a rich color or a well-marked grain, or both. White oak, sycamore, mahogany, birch, red gum, black cherry, and maple when it has a " curly " or a " bird's-eye " grain, are all much used for furniture or interior finish and for panel work; while beech, chestnut, elm, basswood, hickory, locust, and many others are not so much used for these purposes, but are nevertheless very useful for special purposes because of the toughness or hardness of their wood. The locust, which we are to study at this time, is especially useful for posts, poles, ship timbers, or any other purpose that demands toughness and strength combined with durability in contact with moisture. Many woods will decay rapidly when they are subjected to the moisture in the ground or to the ordinary changes in the weather. A good quality of the locust, however, is its durability, especially when in contact with the soil or exposed to the weather. Some of the great railroad companies, which use each year many thousands of railroad ties, have recognized the durability of the locust and are growing and cultivating locust trees on their own land to supply ties, posts, and poles.

In what way does a locust tree differ from other common trees that we see around us? How can we recognize a locust tree when we see it? In the first place, we should know that the locust is one of a family of plants which is very useful to man — *the pulse family.* This family includes many plants the fruit or seeds of which are edible and supply food for man and beast. Peas, beans, and lentils are used by man as food, and they are very valuable foods indeed because they are so rich in proteids. The locust tree, true to the characteristics of its family, bears fruit consisting of a number of dark, orange-brown seeds, about three sixteenths of an inch long and usually with irregular darker markings, enclosed in a reddish brown pod three to four inches long. The presence of the pods, which persist from the time they ripen in the fall until early spring, is one of the distinguishing characteristics of the locust. In the spring the tree may be recognized and identified by its foliage and flowers. The leaves are eight to fourteen inches long, with seven to nineteen leaflets, making what the botanists call a compound leaf — that is, a large leaf composed of several smaller leaflets all growing from the same stem. The leaflets are one half to three quarters inch broad and about one and one half inch long, and generally have a perfectly smooth edge. They are a dull dark green above, and the under surface is paler; and in the fall they turn to a clear yellow. The flowers, which appear late in May

Honey locust in winter

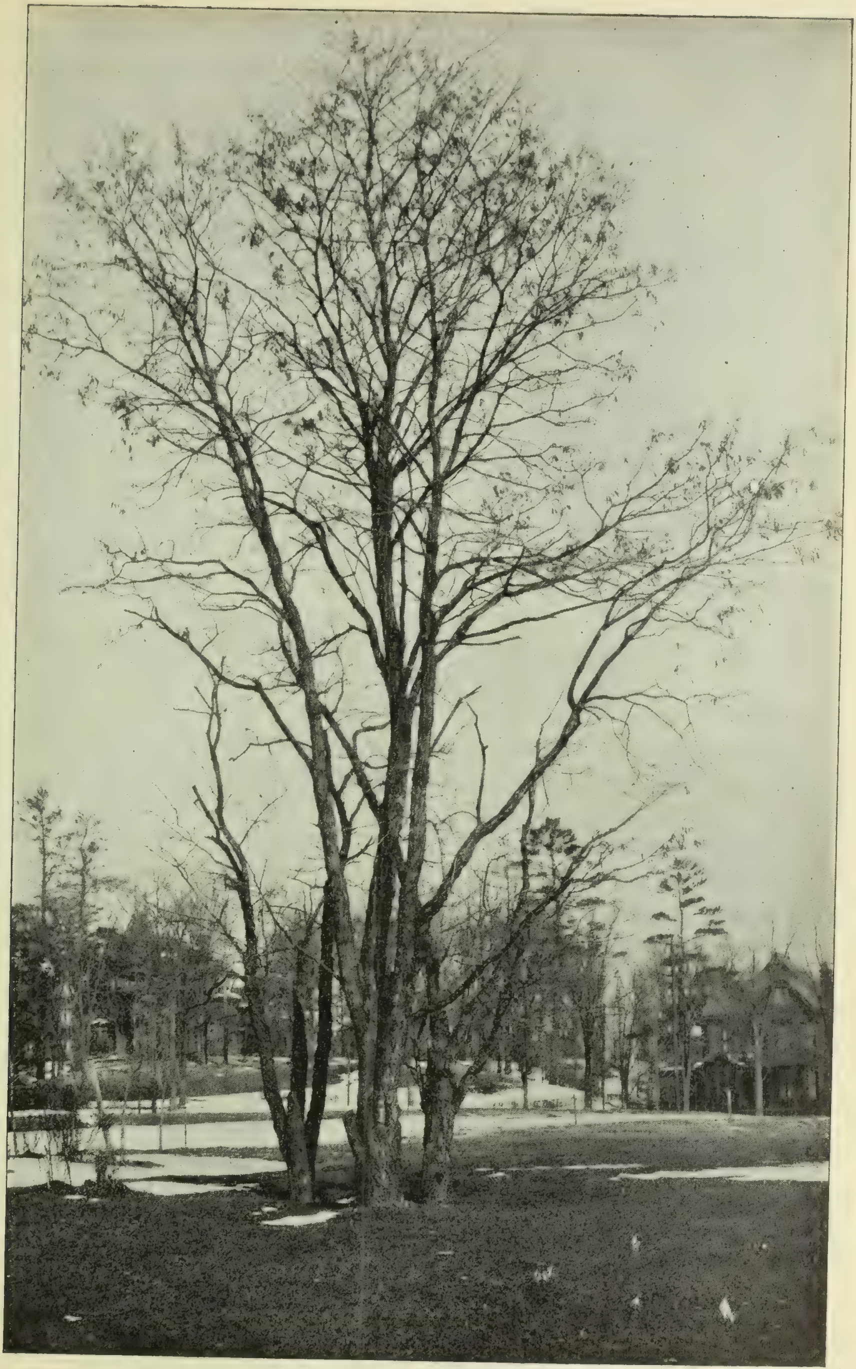
or about the first of June, are borne in loose, drooping clusters; they are creamy white and very fragrant. A locust tree in full bloom is indeed a very beautiful sight.

Where the soil is good the locust tree grows very rapidly when young. It puts out many roots in all directions, which seek the moisture in the soil. Frequently they are so close to the surface of the ground that a number of shoots are sent up. These soon grow and make a thicket of young locust trees. These young trees are very attractive, but they use up much of the moisture in the ground. If, therefore, the old tree is to grow to a good size, it is well to cut the sprouts each year and to keep the ground near the parent tree clear. When a number of locust trees are growing together and are all of about the same age, as in a plantation, there will not be so many sprouts.

The young locust tree grows very rapidly, and at the same time the wood that it produces is hard, strong, and heavy, and is usually a pale yellowish brown in color. Because it is so durable it is useful as posts, railroad ties, or any other kind of timber that is exposed to changes in the weather and dampness in the soil.

The locust tree has an enemy that often destroys it — the locust borer (*Cyllene robiniæ*), an insect that does its destructive work in the form of a grub. It bores holes in the trunk and branches, keeps the tree from growing as it should when in a healthy condition, and may destroy it. In September the beetles — which are about three fourths of an inch long and of a velvety black color, with bright golden yellow markings — gather in large numbers on the bark of the locust trees and lay their small white eggs in the crevices of the bark, in clusters of seven or eight. These eggs soon hatch into little grubs, or worms, of a yellowish color, about three fourths of an inch long. They bore into the bark and work industriously, mining through the softer tissues of the wood until winter overtakes them. They then rest until the warm weather of spring revives them, when they begin work in April or May even more vigorously. They extend their burrows into the wood of the tree, sending out chips and sawdust, by which their work is often detected. The grubs become full-grown about the middle of July, at which time they go through the metamorphosis common to beetles and emerge early in September as beetles.

After a few seasons of this kind of work the tree is doomed. It ceases to make normal growth; it is covered with great scars and wounds, and, like the unprofitable fig tree of the Scriptures, is fit only to be cut down and burned. The sooner it is burned, the better, for if done while the grubs are in it they are killed and prevented from extending the injury to some other tree.



Common locust tree in winter

Nothing is known that will prevent the destruction of the black locust by the locust borer. About the only thing that can be done is to watch the plantation closely, and if it is found that one or two trees have been attacked it is better to cut these down and burn them immediately, so as to prevent the insects from attacking other trees in the plantation. This seems like a somewhat rigorous measure, but after the insects have once made inroads into a tree it is practically impossible to get them out without destroying the tree.

If the locust tree is cared for and protected against these borers, it should soon become large enough for fence posts.

SUGGESTIONS FOR STUDY

Did you ever see a locust tree as large as an elm? as a maple? Is the bark smooth and gray, like that of the beech tree, or is it rough, and dark in color?

Note whether the bark on the branches has prickles on it. Are they stout and strong, or can they be easily broken off? Did you ever see a locust tree blown over by the wind? Do you think strong roots would hold a tree in position against hard winds and storms?

What do the flowers of the locust tree resemble? Notice the leaflets of the locust on a bright, sunny day, and then on a still night; notice how they have folded together; or in cloudy, cold, or rainy weather, see how the leaflets behave. It is one of the habits of members of the pulse family to fold their leaves together at night. If there are pods on the tree, how many seeds are in the pods? How are they fastened to the pods?

In winter notice how the winter buds, which contain the beginnings of next summer's leaves, are protected by being depressed and covered with a scale-like covering, the inside of which is lined with a woolly growth. The tree makes all this careful preparation against cold weather, which might injure the tender leaves in the buds.

If you can find a locust tree that has been cut down and sawed into logs, count the rings of growth on the end of one of the logs. How many rings are there from the center to the edge? Does the tree show a rapid growth?

If a tree is injured, sap will flow from the wound. If the locust tree that you are observing has been damaged by the borers, notice how the sap has run. Be careful not to cause trees needless wounds by chopping into them or by severely bruising the inner bark.

The purpose of the bark is to protect the growing part of the tree, which is just under the bark. How thick is the bark on the locust tree? The sap carries water and plant-food from the roots to the leaves and from the leaves to the growing parts of the tree. That is why it is so important to keep the bark from being injured, for if the bark is cut or bruised, or bored into by insects, the tree loses sap and is weakened.

Compare the blossoms of the locust tree with the blossoms of the common sweet pea of the garden. Compare the fruit with the pea or the bean grown in a garden.

Take some of the seeds of the locust and soak them for several hours in hot water (not boiling, but about 135° to 150° F.). Do this for three or four successive days, or until the seeds swell, taking care not to let them dry out at any time. Plant them in soil in a box that can be kept in a warm, sunny place, and compare them with seeds sown at the same time but not previously soaked in hot water. Give them water each day in order to keep the soil moist. See how many days it takes for the soaked seeds to germinate. Have the seeds that were not soaked begun to show signs of germinating? How do you account for the success of locust trees in growing from seed in nature?

The presence of nodules on the roots of legumes is a family characteristic. Look on the fibrous roots of young locust trees and see whether you can find nodules.

HEMLOCK, BEECH, BIRCH, CHESTNUT, CEDAR

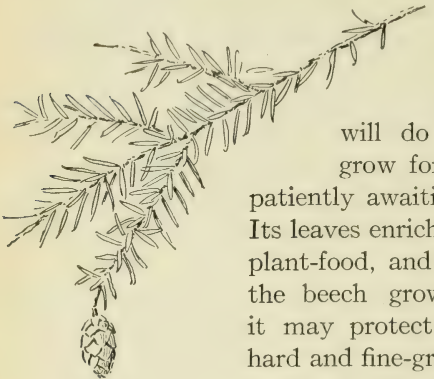
JOHN BENTLEY, JR.

T*HE hemlock.*— The hemlocks, spruces, and firs (balsams) have linear leaves; that is, the sides are nearly parallel and the length is several times greater than the breadth. The cones of the firs are erect, while those of hemlocks and spruces hang down. The leaf of the hemlock has a very small stalk attaching it to the twig, while the spruce leaf has no such stalk. The leaves of the spruce stand out from all sides of the twig, while those of the hemlock appear to be mostly in one plane, giving the twig a more flat appearance than that of the spruce.

The beech.— This tree, which is a companion of the maple and the birch in our Northern forests, belongs to the same family as does the chestnut. It is distinguished in winter by its smooth, gray bark and its long, thin, pointed buds; in summer by its shiny leaves, somewhat resembling those of the chestnut but not so sharply toothed; and in fall by the fruit, which resembles slightly a chestnut bur, and which contains a little, triangular, brown nut.

The beech likes cool, moist, rich soil on the north slopes of our hills and mountains, and always grows to the best advantage where the soil is good. Although sometimes found on rocky ridges, it never grows very tall in such situations, but spreads out, with many branches and a round-headed crown. In the dense forests it grows with a tall, clear trunk, the bark of which is very beautiful.

The beech, like the hard maple, will do with very little sunlight and will grow for years overtopped by its neighbors, patiently awaiting a chance to reach the sunlight. Its leaves enrich the soil by returning to it valuable plant-food, and for this reason foresters like to have the beech growing underneath other trees so that it may protect the soil and enrich it. Its wood is hard and fine-grained, and is used for parts of cheap furniture, flooring, woodenware, and fuel.


Hemlock

The birches.— There are four common birches in New York State: the black, or sweet, birch; the paper birch; the yellow birch; and the gray birch. Of these four the first three grow to be large forest trees and are of considerable value for their products.

The *sweet birch* produces a wood which, when finished, closely resembles mahogany, and it is largely used in the manufacture of furniture and in interior finish. From the bark of this tree an oil is distilled which has the flavor of wintergreen. In the Southern mountains a number of the mountaineers earn a large amount of money by making birch oil.

The *paper birch* is familiar to us as the tree that yields birch bark. This can be peeled from the tree readily and was formerly used by the Indians in making their canoes. It is now used largely for the manufacture of fancy souvenirs.

The *yellow birch* has a bark which peels off in papery strips like that of the paper birch, but instead of being white it has a dull yellow color. The yellow birch is valuable chiefly for fuel and for small wooden articles.

The little *gray birch*, which rarely exceeds thirty or forty feet in height, is familiar to us as the tree that gains a foothold in old pastures, or that comes up on burned-over land after a fire has killed the other trees. The reason for this is the fact that the seeds are very light and small, and can be blown for long distances by the wind. While this tree is not valuable in itself, it is of use because it occupies ground that would otherwise be very difficult to reforest.

Beech

After the gray birch has made the beginning of a new forest, other trees gradually creep in, and under the protecting shade of the birch trees these soon become well established and overtop the birches. Many of these trees would be unable to succeed if they were not thus protected by the birches. Here we have a lesson of the usefulness of a small tree which in itself possesses very little value.

Gray birch

The chestnut.— Next to the much-loved Christmas tree, the chestnut is perhaps the most familiar tree to all boys and girls. This is doubtless due to its natural abundance and to the fact that the nut is eagerly sought as an article of food. One of the remarkable things about the chestnut tree is that only three months elapse between the time when the tree blossoms and the time when the fruit is ripe. Most of our forest trees bloom early in the spring, but the chestnut waits until the last few days in June or the first of July before it puts forth its flowers; and, whereas some trees require two seasons in which to ripen their fruit, the chestnut produces one of the largest and best-flavored nuts within three months.

The wood of the chestnut tree, because of its durability when set in the ground, has been used very largely for posts, poles, and railroad ties. It makes rather coarse, rough lumber, but is sometimes used for interior finish also.

Chestnut

A few years ago a disease of the chestnut tree escaped from Long Island, where it had developed, and it has now spread through many of the Eastern States. This disease, known as the chestnut bark disease, threatens to exterminate the chestnut tree wherever it is found. A large amount of money has been spent in trying to stop the progress of the disease, but all to no purpose. A tree that has been attacked by this fungus begins to die at the top, and as the disease works downward one branch after another dies until finally the whole tree is dead.

The white cedar.— Two common trees are frequently spoken of as white cedar, and as a result much confusion exists. The first one, which has flat, frond-like foliage, is sometimes called arborvitæ. The other, which is less common in New York, has small, scale-like leaves, and is found only in wet, swampy places; it is known as the white cedar. They may best be distinguished by their cones. The cones of the arborvitæ are oblong and consist of six or eight small scales which are rather loose. The cones of the white cedar are small, spherical bodies with numerous points or knobs. At first they are light green, becoming bluish purple and finally dark red-brown. The arborvitæ is the tree that will be found most frequently by the boys and girls, because the white cedar is a tree of the swamps and prefers a warmer climate than that of New York State.

While not very large, both these trees yield wood which is aromatic and very durable. For this reason, many cedar trees are used as fence posts.

The arborvitæ is frequently planted as a hedge fence, and when trimmed it makes a very beautiful substitute for the unsightly board and wire fences which are all too common.

AN APPLE TREE

THE EDITORS

What plant we in this apple-tree?
Buds, which the breath of summer days
Shall lengthen into leafy sprays;
Boughs where the thrush, with crimson breast,
Shall haunt, and sing, and hide her nest;
   We plant upon the sunny lea,
A shadow for the noontide hour,
A shelter from the summer shower,
   When we plant the apple-tree.

WILLIAM CULLEN BRYANT

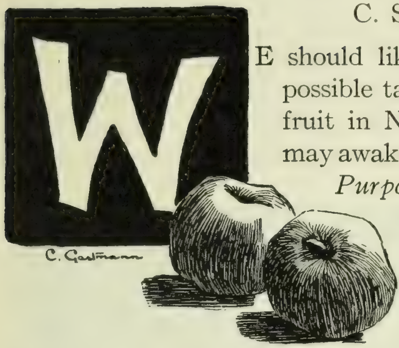
Boys and girls in a rural school, autumn weather, a successful fruit-grower of the community, and a progressive teacher; with these we have opportunity to open young minds to the wonders of an apple tree. But even if all these possibilities are not at hand, the teacher should make use of what she has and give the children a real touch with this country-life subject, which is full of interest and has direct relation to their lives.

The study of the apple may well be introduced in autumn, either in city or country, by having an exhibition. The exhibition may be very simple, but it should include all the kinds of apples that can be found in the neighborhood. It will furnish material for language lessons on color, form, and the like. A farmer in the community who has knowledge of apple culture will probably be willing to give a talk on the subject in the schoolroom; and this will be one of the best features of the study. The home and the school having mutual interests will strengthen all education, particularly rural education.

LESSON ON THE APPLE

PRACTICAL SUGGESTIONS

C. S. Wilson



WE should like to have as many boys and girls as possible take an active interest in improving the fruit in New York State. The following lesson may awaken interest if some concrete work is done.

Purpose.— To teach pupils the varieties of apples grown in their section, and to suggest other varieties well adapted to similar conditions.

How to study the varieties.— If possible, have a Fruit Day in the fall. It should be advertised in advance, and the children should be asked to bring different varieties of as many fruits as they can, so that an exhibit can be placed in the schoolroom. Tables may be used for this purpose and the fruit placed on paper plates. In arranging this exhibit, the different classes of fruits may be placed together and the varieties of each neatly and correctly labeled. Small prizes may be offered and the children encouraged to compete for them. The teacher may ask a successful fruit-grower to come to the school at the time of the exhibit and name the varieties. He might also act as judge of the fruit contest.

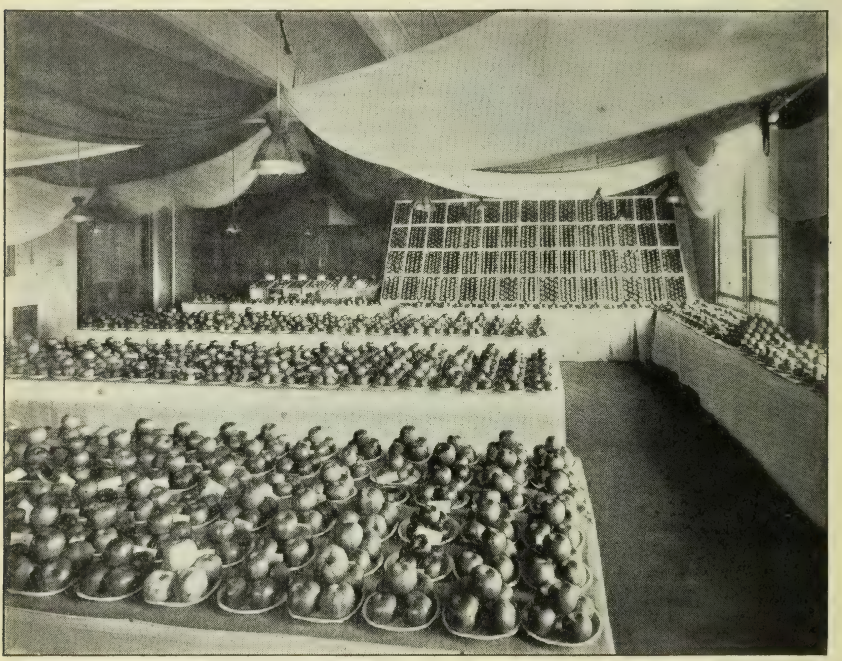
How to choose fruit.— The first-class fruit for exhibition purposes should be a large specimen of the variety, regular in size, and having the shape and color typical of that variety. Five specimens of each variety constitute a plate, and these five specimens should be of as nearly the same size and color as possible. One extra and overgrown specimen would not be desirable.

All specimens should be free from bruises and insects. No wormy fruit should be placed on the plate. Each specimen should have a full-length stem.

How to collect.— Collect large specimens of even size and color. Select them carefully, avoiding all bruises and broken stems. Have six specimens of each variety, so that if one should be bruised or should be found to have a blemish it could be removed and five specimens be preserved.

How to arrange on plate and on table.— Place four specimens on the bottom of the plate, with stem ends up. Place the fifth specimen in the center on top of these four. Arrange the label on the side, where it can be plainly seen and yet where it will not be conspicuous when looking over the fruit. Arrange the plates on the table, leaving an inch or so between each two plates, if there is sufficient room. It is well to place the plates in rows and then to bring in different color effects. Make various figures with the green fruit and the red fruit.

Varieties.— From the varieties brought by the children, choose those that are most common. If the choice has been made from several fruit farms in the neighborhood, probably these common varieties will represent the apples that are grown most extensively there. These will be the apples best adapted to the section, and will therefore be worth growing for commercial purposes.



Fruit exhibit at Cornell University

Compare the varieties in the exhibit with the standard varieties grown in the commercial orchards of this State. A short list of the common varieties is as follows:

Baldwin
Northern Spy
Esopus (Spitzenburg)
Fameuse (Snow Apple)
Rhode Island Greening
Tompkins King
Hubbardston
Roxbury (Russet)

Are the varieties grown in your section the same as these? If not, encourage the children to try some of the new varieties.

Ask the children to tell the conditions under which the varieties of apples in their section were grown, and to compare the size, color, and appearance of the fruit grown under good conditions with that grown under poor conditions. This will teach the lesson that the best fruits are grown in the orchards that are thoroughly cultivated, fertilized, pruned, and sprayed. It will also teach that unless these operations are conducted on the fruit farm the apples will not be first-class.

Ask the children to compare the various specimens of the same variety — for example, the Baldwins grown on the home farm of one of the children with those grown on another farm in a different part of the neighborhood. This will bring out the lesson that there is variation in the same variety. This variation may be due to cultural methods, or it may be due to the inheritance or the pedigree of the stock. A difference in the inheritance or the pedigree of the stock will teach that buds or scions from which commercial orchards are started should be chosen from trees which not only bear well but also bear the best fruit of that variety. Most commercial orchards at the present time are being set with strong, healthy trees from the nursery row, and then top-worked to the desired varieties with properly chosen scions.

How to plant an apple tree.— The apple tree is bought from the nurseryman in the fall or the spring. It should be two years old, and of the variety Northern Spy. The tree is planted in spring as soon as the ground can be worked. Dig a round hole large enough to receive the roots of the tree, and deep enough to plant the tree three or four inches deeper than it was in the nursery row. This will cover the bud and the crook near the base. When the hole is dug, throw back into the bottom a few shovelfuls of the good surface dirt; then place the tree in the hole. Let one pupil hold the tree straight, while others throw in the soil, at the same time working the soil between the roots with the fingers. Step on the soil and tramp it down firmly. Fill the hole up level with the surrounding surface.

Pruning.— After the tree has been set, it should be pruned. Choose three or four side branches, about three feet high, for the main branches. Cut these down to within six or eight inches of the main stem. Cut off all other branches close to the stem, and finally cut back the top of the stem.

The tree will start in the spring and grow during the summer. In August it should be budded to the variety desired. Good eating varieties for New York State are McIntosh, Red Canada, Esopus (Spitzenberg), Tompkins King, Jonathan, and Northern Spy.

THE PLUM

H. B. KNAPP

The plum is one of our most difficult fruits to study — difficult from the fact that the species and varieties of this tree are so numerous and so mixed by crossing that it is almost impossible to describe and classify them satisfactorily.

This is perhaps one of the least popular of our tree fruits. The fruit is used largely for canning, and in certain parts of the United States the drying of one type of plum, the prune, has become an industry of considerable importance. We commonly speak of the prune as being a more or less distinct fruit, but in reality it is a plum with flesh thick enough and firm enough to give a satisfactory product when dried.

Almost all our cultivated plums have come from Europe, although their native home was probably western Asia. Among these plums may be mentioned Lombard, Reine Claude, Bradshaw, and the Damsons. The Japanese types of plums are also grown largely now, but these varieties are of only fair quality. The quality is usually improved greatly by severe thinning of the fruit, because the trees are likely to over-bear. Two of the most common varieties of Japanese plums are Abundance and Burbank. In addition to the plums mentioned here there are many other types and species, some of them native to this country. These native plums apparently afford an important field for the improvement of our present-day varieties both in quality and in hardiness, and indeed it will not be surprising if future generations develop them to such an extent that they largely replace those which have come to us from other lands.

The plum will succeed on a fairly heavy soil, but the soil should not be a wet one. A good pear soil is in many respects a good plum soil, while the soil which is most favorable for the growing of peaches is a little lighter than that on which most varieties of plums thrive best. The Japanese varieties prefer a lighter soil than do the other varieties. The axiom which might be laid down, that fruit trees should never be planted in sod or on sod ground, holds true in regard to the plum. Next to the cherry it will thrive in sod better than will other tree fruits, but this does not mean that the plum will not respond to proper treatment when it receives it. The land, then, should be used for some tilled crop the previous year, in order that the sod may have an opportunity to decay partially before the tree is set.

The plum is commonly planted in spring, although in milder sections of the State it may be planted with safety in the fall provided the land is well drained and the trees are mature when dug at the nursery. Both one-year-old and two-years-old trees are used, although most of them are of the latter age.

The distance of planting will vary somewhat with the varieties and with the richness of the soil. The trees should be not much less than twenty feet apart. The grower is more likely to set them too close than too far apart. Pruning in the first year should consist of removing all but three or four branches that are so distributed as to make a well-balanced top. These branches will later become the framework of the head of the tree. The plum does not require so much pruning as do some of our other fruits, nevertheless attention should be paid to this each year. If done properly and if the branches are taken out when they are small, little pruning will be necessary when the tree reaches maturity. The land should be worked with a plow or a harrow in the same manner as it is worked for other orchard fruits.

Most of the plums bear fruit on wood that is more than one year of age, usually on two-years wood or older. Fruit buds are formed on dwarf branches, known as fruit spurs. The Japanese varieties, however, and to a certain extent some of the other varieties, bear fruit from buds on one-year wood. It is usually well to thin the fruit.

The most serious pest of the plum is the curculio, which stings the fruit, causing it to drop to the ground. This may be partially controlled by deep cultivation in July and August, which helps to destroy the insect while it is passing part of its life in the ground; but a better means is to thoroughly spray with arsenate of lead, six pounds to one hundred gallons of water, just as the shucks, or withered blossom parts, are falling from the fruit.

The average life of the plum tree is in the neighborhood of twenty-five to thirty years, although it will live longer if grown under conditions that are especially suited to it. There are many varieties of plums that succeed in New York State, but it is always best to plant the varieties that are known to succeed well under the local conditions. Among the most popular and satisfactory varieties are: Bradshaw, Reine Claude, Italian Prune (or Fellenburg), Duane, Lombard, Shropshire Damson, and Grand Duke. The Damson plums are used for preserves and the like. Two of the most widely grown Japanese plums are Abundance and Burbank. The Burbank is preferable for the home garden, but neither of these varieties is entirely hardy in the colder sections of the State. Some variety of plum can be grown in nearly every part of New York State. The essential factor to be kept in mind is to choose the varieties best adapted to the conditions under which they are to be grown. It is much better to consult with a neighbor who is growing plums successfully than to heed the advice of the tree agent.

PART II

PAUSE

L. H. BAILEY

Some sounds I hear at gray twilight—
I pause that I may hear them right.

I hear a wagon yonder-way
It has a sound like close of day;
Some person spoke something somewhere
It almost broke the hollow air;
Two leaves strike thinly on the bough
The leaves are flapping tunely now;
The wind sinks down with such caress
That I can hear its silentness;
There is a tinkle like a bell
I think it sounds the day farewell.

Some sounds I hear at soft twilight
And I can feel the answer quite
Along the marges of the night.

THE SCENT OF THE GROUND

JAMES G. NEEDHAM

IN the not distant future a bit of woodland, unimproved, is going to be valued as a part of our educational equipment. Not a commercial forest; not a stately grove; not a well-kept farm woodlot; but just a wild and neglected mixture of wood and thicket and vines and bushes, with tender green things in the shadows: tangled slope and sedgy swale, where all manner of wild things have their home; where wild flowers bloom and wild fruits gleam among the boughs, and wild roots welter in the rich and fragrant black mold. A haven of refuge for wild things? Yes; for they justify a reservation. Man does not live by bread alone. The wild things are things of beauty and a perpetual joy. They may be exterminated but they may not be recreated. They are the products of the evolution of the ages, and when gone from earth they are gone forever. It is worth while to keep them for their own sakes.

But I was thinking of other values the wild wood has for us. It was the home of our ancestors. It furnished them all their food, their clothing, their shelter, their earliest tools and weapons. It set them tasks and offered them rewards. It beset them with problems, yet offered hints for their solution. Back to the wild wood we must go to rightly sense the sources of our living.

By following nature's hints we have made some progress in manipulating the life of the world in our own interests. About this progress we are wont to make much noise. But we have little altered anything that nature ever gave us. As food and shelter and clothing were obtained in the days of Abraham, so in the main they are obtained now. Few sources of new materials have been added; none have been eliminated. The same great groups of animals furnish us flesh, and milk, and wool; the same plants furnish us cereals, and fruit, and roots, cordage, and fiber, and staves. The beasts browsed and bred and played, the plants sprang up and flowered and fruited, then as they do now. We have destroyed many to make room for a chosen few. We have selected the best of these and by tillage and care of them we have greatly enhanced our sustenance. But we have not changed nature or the sources of it.

In the wild wood we have these economic groups of plants and animals as they came to our forebears from the hand of nature, untamed — her cereals and roots growing in scattered patches, her fruits a prodigal offering, small and seedy, sweet and sour, wholesome and bitter. These she offered, not to us alone, but to all the hungry creatures of her woodland population. A few of them we have elected to preserve and increase; the others let us not wholly destroy.

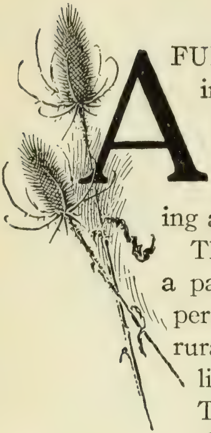
We need the woodland, also, to show us what nature's system of cropping was — and is. Her tillage is slow, but thorough — tillage by frost, by burrowing of animals, by thrust and decay of roots, and by overturn of soil with the falling and uprooting of trees. Her rotation of crops is so managed as to keep the soil covered. She conserves the humus to the perpetual enrichment of the soil. She keeps it fertile and fragrant. For her enduring methods, we have substituted a rapid and wasteful system of tillage and cropping that yields quick returns but soon dissipates the patrimony of the ages and leaves the land lean and bare. From nature we may yet learn a better conservation. We need to go back to the wild wood for new hints from her. There we shall see also that she has crops for every situation — water and land, sun and shade. Only with crops that will grow on plowed fields have we made much progress as yet.

We need the untamed woodland, also, for the lessons of beauty it teaches. Where else do we find such infinite variety of design, such masterful bits of composition, such finishings and furnishings as are there wrought out with moss, and lichen, and fern? Where else do we find leafy sprays so exquisitely poised? Often the shifting of one of them spoils a picture.

I do not disparage the garden. It also educates us. It keeps before us the infinite wonder of bursting seed, and budding leaf, and opening flower. In the garden we work with our hands. We isolate the live things for closer study. We learn experimentally of their struggle for existence. We feel their response to our care. When we tend a garden we learn to adjust conditions and to wait. Thus experiment supplements observation. Both are necessary. We need the wild wood to observe in to see how nature does things; to get further hints from her. The garden has done much toward developing our race — is doing much to sustain our race — we are in no danger of losing it. But the wild wood is needed also; let us make sure that we shall always have both. Plenty of gardens and at least a bit of wild wood in every community — for remembrance.

THE POINT OF VIEW

L. H. Bailey



A FUNDAMENTAL necessity to successful living is to be in sympathy with the nature-environment in which one is placed. This sympathy is born of good knowledge of the objects and phenomena in the environment. The process of acquiring this knowledge and of arriving at this sympathy is now popularly called nature study. The nature-study process and point of view should be a part of the work of all schools, because schools train persons to live. Particularly should it be a part of rural schools, because nature-environment is the controlling condition for all persons who live on the land. There is no effective living in the open country unless the mind is sensitive to the objects and phenomena of the open country; and no thoroughly good farming is possible without this same knowledge and outlook. Good farmers are good naturalists.

For many years it has been one of the purposes of the College of Agriculture in New York to point the way to this nature-sympathy; and, inasmuch as this nature-sympathy is fundamental to all good farming, it was conceived that the first duty of any movement was to lend the effort to the establishing of an intelligent interest in the whole environment — to knowledge of fields and weather, trees, birds, fish, frogs, soils, domestic animals. It would be incorrect to begin first with the specific agricultural phase of the environment, for the agricultural phase (as any other special phase) needs a foundation and a base: it is only one part of a point of view. Moreover, to begin with a discussion of the so-called "useful" or "practical" objects because they are practical, as many advise, would be to teach falsely; for, as these objects are only part of the environment, to single them out and neglect the other subjects would result in a partial and untrue outlook to nature; in fact, it is just this partial and prejudiced outlook that we need to correct. But because certain objects and subjects are "practical" is of course no reason why they should be avoided. The web of life is woven of many strands.

In our own effort, we have always had in view the agricultural aim or application. We should have been glad if there had been sufficient nature-study sentiment to enable us to confine our particular work to the agricultural aim; but this sentiment had to be created or quickened, and we have tried to contribute our part toward accomplishing this result. At first it was impossible to gain much hearing for the agricultural subjects. Year by year such hearing has been more readily given, and the work has been turned in this direction as rapidly as the conditions would admit — for it is the special mission of an agricultural college to extend the agricultural applications of nature study. In later years the content of the work has had very direct relation to farm-life questions. The time has now come, we think, when we can devote practically all our energies to this application. It is the purpose of this leaflet to aid the teacher in the rural school to work out the practical daily problem of teaching agricultural subjects.

In doing this, we merely confine ourselves to our more special field. The general nature-study outlook is fundamental, and we shall continue to emphasize it; but we feel that the appreciation of this outlook is now so well established as to allow us to specialize. The University of the State of New York has issued syllabi for agriculture and nature study; we desire to be useful in applying them to the conditions and needs of country life. Schools here and there are ready for agricultural work; we want to help.

In making these statements we have in mind that the common schools do not teach trades and professions. We do not approach the subject primarily from an occupational point of view, but from the educational and spiritual; that is, the man should know his work and his environment. The mere giving of information about agricultural objects and practices can have very little good result with children. The spirit is worth more than the letter. Some of the hard and dry facts on farming would only add one more task to the teacher and the pupil if they were introduced to the school, making the new subject in time as distasteful as arithmetic and grammar often are. In this new agricultural work we need to be exceedingly careful that we do not go too far, and that we do not lose our sense of relationships and values. Introducing the word "agriculture" into the scheme of studies means very little; what is taught, and particularly how it is taught, is of the greatest moment. We hope that no country-life teaching will be so narrow as to put only technical farm subjects before the pupil.

We need also to be careful not to introduce subjects merely because practical grown-up farmers think that the subjects are useful and therefore should be taught. Farming is one thing and teaching is another. What appeals to the man may not appeal to the child. What is most useful to the man may or may not be most useful in training the mind of a pupil in school. The teacher, as well as the farmer, must always be consulted in respect to the content and the method of teaching agricultural subjects. We must always be alert to see that the work has living interest to the pupil, rather than to grown-ups, and must be on guard that it does not become lifeless. Probably the greatest mistake that any teacher makes is in supposing that what is interesting to him is therefore interesting to his pupils.

All agricultural subjects must be taught by the nature-study method, which is: to see accurately; to reason correctly from what is seen; to establish a bond of sympathy with the object or phenomenon that is studied. One cannot see accurately unless one has the object itself. If the pupil studies corn, he should have corn in his hands and he should make his own observations and draw his own conclusions; if he studies cows, he should make his observations on cows and not on what some one has said about cows. So far as possible all nature-study work should be conducted in the open, where the objects are. If specimens are needed, let the pupils collect them. See that observations are made on the crops in the field as well as on the specimens. Nature study is an outdoor process: the schoolroom should be merely an adjunct to the out-of-doors, rather than the out-of-doors an adjunct to the schoolroom, as it is at present.

A laboratory of living things is a necessary part of the best nature-study work. It is customary to call this laboratory a school garden. We need to distinguish three types of school garden: (1) The ornamented or planted grounds; this should be a part of every school enterprise, for the premises should be attractive to pupils and they should stand as an example in the community. (2) The formal plat-garden, in which a variety of plants is grown and the pupils are taught the usual handicraft; this is the prevailing kind of school gardening. (3) The problem garden, in which certain specific questions are to be studied, in much the spirit that problems are studied in the indoor laboratories; these are little known at present, but their number will increase as school work develops in efficiency; in rural districts, for example, such direct problems as the rust of beans, the blight of potatoes, the testing of varieties of oats, the study of species of grasses, the observation of effect of fertilizers, may well be undertaken when conditions are favorable, and it will matter very little whether the area has the ordinary " garden " appearance. In time, ample grounds will be as much a part of a school as the buildings or seats now are. Some of the school-gardening work may be done at the homes of the pupils, and in many cases this is the only kind that is now possible; but the farther removed the laboratory, the less direct the teaching.

The school should reflect the work and the needs of its community. If the community is pastoral — and all rural communities are pastoral — then the school should have a pastoral sentiment and feeling. Actual farm experience has great power in the training of the young. We had not realized how much real value it has until we measured the inadequate results of much of the city experience and of much of the formal traditional school work. We are now to catch up these rural experiences and practices into a working plan of education, and we shall make the open country a real background of school work. We are all experimenting with the subject now, if not even playing with it; but it is becoming more real, and in time we shall have a genuinely pastoral motive running through the schools. The out-of-doors is the background of civilization.

In order to introduce agriculture into any elementary rural school it is first necessary to have a willing teacher. The trustees should be able to settle this point. The second step is to begin to study the commonest and most available object concerning which the teacher has any kind of knowledge. The third step is to begin to connect or organize these observations into a method or system. This simple beginning made, the work should grow. It may or may not be necessary to organize a special class in agriculture; the geography, arithmetic, reading, manual training, nature study, and other work may be modified or redirected. It is possible to teach the State elementary syllabus in such a way as to give a good agricultural training.

In the high school the teacher should be well trained in some special line of science; and if he has had a course in a college of agriculture he should be much better adapted to the work. Here the teaching may partake somewhat more of the laboratory method, although it is possible that our insistence on formal laboratory work in both schools and colleges has been carried too far. In the high school, a separate and special class in agriculture would better be organized; and the high school syllabus of the University of the State of New York provides for this.

In all agricultural work in the schools of the State, the College of Agriculture desires to render all the aid that it can. Correspondence is invited on the agricultural questions involved. In special cases an officer of the College may be sent to give advice on the technical agricultural phases of the teaching. Considerable literature in the publications of the College is now available and will be sent on application.

In many districts the sentiment for agricultural work in the schools will develop very slowly. Usually, however, there is one person in the community who is alive to the importance of these new questions. If this person has tact and persistence he should be able to get something started. Here is an opportunity for the young farmer to exert influence and to develop leadership. He should not be impatient if results seem to come slowly. The work is new; it is best that it grow slowly and quietly and prove itself as it goes. Through grange, reading-club, fruit-growers' society, creamery association, or other organization the sentiment may be encouraged and formulated; a teacher may also be found who is in sympathy with making the school a real expression of the affairs of the community; the school premises may be put in order and made effective; now and then the pupils may be taken to good farms and be given instruction by the farmer himself; good farmers may be called to the schoolhouse on occasion, to explain how they raise potatoes or produce good milk. A very small start will grow by accretion if the persons who are interested in it do not lose heart, and in five years every one will be astonished at the progress that has been made.

A CHAT WITH RURAL TEACHERS

Alice G. McCloskey

IN THE majority of cases we find that teachers prefer to be in cities. But fortunately there are those who need to be in the open country, where green things grow and where sky and wood and song of bird deepen and enrich the day; and where, for part of the year, there is all the magic of winter and its rugged gifts — the sparkling, snow-covered fields, the silent "snow-choked wood," the new mystery of starlight and moonlight, and the deep, wild winds.

There are in New York State some excellent rural schools, but many of them have been greatly neglected in the past. A survey of the buildings, the grounds, and the equipment of the educational centers of rural districts would, in a large number of cases, reveal conditions that indicate serious lack of interest. From these schools should come some of the strongest national leaders, since boys and girls in the country have rare opportunities for development, not the least of which are their contact with nature, their habits of industry, their experience in taking responsibility. These advantages should be supplemented by good instruction in dignified surroundings.

At the beginning of the school year it is always well for a teacher to have in mind some specific improvements to be made before its close, and to keep a record of each when it is made. This will give opportunity at the end of the year for a survey of the work accomplished. Such a record will be of value in succeeding years. Perhaps the following suggestions, many of which have come from rural teachers, will be helpful in planning future work:

In every rural district there should be at least two **meetings of parents** each year, at which times the teacher may present her plans for the progress of the school and ask for the cooperation that will be needed in order to work them out. Perhaps the most important subject for discussion is the improvement of school buildings and grounds. If at the first meeting a few simple, essential suggestions are given, there will be less difficulty later in getting additional help from the district.

The first effort for the improvement of the interior of the **school building** should be to make it comfortable and clean. Simple white curtains at the windows, made by the girls, will add much to the homelike appearance. One good picture will be better than many that are small and unattractive. There should be at least one bookcase. One of the parents may be willing to make many of the repairs. A few of the mothers will doubtless be willing to help the girls to make the schoolroom neat and attractive. If there is in the building no copy of the Cornell Rural School Leaflet on decoration for the Rural School, please send for one.

The **school grounds** should be discussed. Doubtless two or more of the men will be willing to help plant simple shrubbery about the building, giving the older boys the educational opportunity of helping in this work. Fences should be repaired, definite walks made, and the entrance to the school should be as clean and as attractive as soap and water and fresh paint can make it.

A most important subject to present at a meeting of parents is the necessity for the children to have a good **physical background** for their life work. The health of boys and girls of school age should receive constant attention. If children are breathing through their mouths instead of through their noses, the cause should be investigated. Care of the teeth is most important. Many persons have been handicapped through life because their teeth were not taken care of in childhood. Fresh air in the sleeping-room should be discussed.

Teachers and parents, with full realization that **character** is more important than intellectual development, can work together to establish higher ideals among the young persons in the community. A child should be taught to respect his body; to stand on two feet; to be able to look with honesty into the face of any one to whom he is speaking; to play fair; to finish a piece of work in the best way possible; to be reverent in spirit.

Teachers frequently have better opportunity to observe the **habits** of boys and girls than do their parents. The entire future life depends largely on the habits formed in childhood; and because of this, we, who are constantly with children, must take some responsibility that each day the good habits strengthen and the habits of weakness gradually decrease. It may be helpful to the teachers to read over some things that we have in mind as we consider the welfare of boys and girls:

(1) It is important to form habits that lead to good health: cleanliness; fresh air; cleaning the teeth; caring for the eyes; taking exercise; standing erect; and the like. (2) Habits that are of value in personal association with others: thoughtfulness of parents and older persons; courtesy; a quiet voice; good manners; an aversion to gossip; avoidance of petty or unjust judgments; punctuality. (3) Strengthening habits of honesty; playing the game straight. (4) The habit of finishing a piece of work in detail. (5) Forming the habit of committing good literature to memory. (6) Forming habits of close observation. It is important for the children to appreciate that a person of culture is always able to see the other person's point of view.

It will be well also for the teacher to express her desire to help in teaching **good manners.** Loud voices, boorish ways, lack of consideration of older persons, and rough, boisterous habits of intercourse, will often defeat young persons in many opportunities for growth and for pleasure that might otherwise be theirs. Children should be taught the reasons why definite social forms are observed. If this work is done with seriousness and with sufficient frequency, the children will soon realize its importance.

If the plans of the teacher include instruction in **nature study and agriculture,** parents should understand the place that these subjects now have in the educational world. Many parents will say that they know more of agriculture than does the school-teacher. This is doubtless true, but all lines of endeavor are dignified when made a part of the educational system; and when boys and girls work out with the teacher some problem in farm practice, the lesson may be connected with other school subjects, such as geography, language, arithmetic, and the like. Some parents object to nature study because they have not fully realized that all boys and girls on the farm need for their best success a natural-history background. Many farmers possess this without knowing how it was obtained. Since natural-history subjects have educational value, they may well be presented with other school work.

In the teaching of nature study and elementary agriculture, it may be helpful to have in mind the following:

During the first six grades in school, out-of-door study should develop the spirit of the **naturalist** — a general interest in the out-of-doors. If properly taught, at the end of this period the child interested in natural forces and objects will have acquired a spirit of patient inquiry and accuracy in observation. He will begin to realize the kinship of out-of-door objects and the possibilities of interest and resource in them.

Teachers in country schools will find, however, that many of the boys and girls are not interested in nature-study from the viewpoint of the naturalist. The pupils should not be forced into this interest, but should

Roland H. Hodge and his pet Worden, fourth year from layer be allowed to turn their minds to the more **practical side of the subject.** We have found very young children much interested in the commercial side of poultry-raising, growing potatoes, and the like. Let us encourage these boys and girls, and, if the teacher will help, they will get the point of view of the naturalist. A field of timothy is as beautiful as a field of violets. Who has not felt his spirit quicken at the sight of a field of oats in the sunlight or in the early evening? Who has failed to see the beauty

Preparing the terrarium for visitors

of pumpkins in the cornfield in the " blue October weather "? What form of animal life is more attractive than young chicks or ducklings?

The work for the seventh and eighth grades, as outlined in the elementary syllabus, has relation to **agriculture** and may be intensified according to the amount of time given to it and the interest of the teachers and pupils. Each lesson should lay the foundation for fundamental agricultural knowledge which will be introductory to high-school and college work in these subjects. We would advise teachers of the seventh and eighth grades to follow the work outlined by the syllabus for these grades, choosing for the most serious study, however, the subject that is of greatest interest in the community; as fruit-growing, raising of farm crops, dairying, or the like.

If **fruit-growing** is the special interest in the community, begin in autumn with discussions of the marketing of apples or other fruit. Have the pupils collect specimens of all varieties to be found in the neighborhood. Have these identified and labeled for a school exhibit. Discuss the most popular variety of fruit in your community, and send the pupils on a quest to learn why it is the most popular. Ask a successful fruit-grower in the community to give a talk on the subject. Sometime in the school year plant a fruit tree. Let the tree planted by each class have significance and stand for a permanent piece of work. Have the children realize, even in the most elementary way, the interrelation and interdependence of outdoor things. For example, the study of soils in these grades will be most interesting, and will have added value if made in the interest of a tree to be planted. Discuss the advantage of having a home fruit-garden. Boys and girls will take an interest in such a garden. A later publication will give specific helps for this work.

If **dairying** is the chief interest in the community, choose the subject matter as outlined in the syllabus, for which specific material can be found. In country places a visit should be made to a farm in order that the children may learn the types of cows and begin to think about pure breeds of cattle. A Babcock test machine might be placed in the schoolroom, and milk from different farms tested by the pupils. When the test has been successfully made in the schoolroom it would be valuable to have the class make this test at a grange meeting or a farmers' institute. The matter of balanced rations may be studied, also other subjects of interest on a dairy farm.

In order to encourage the children in their general out-of-door observations, many teachers have found it helpful to have in the schoolroom a **nature-study corner.** There should be a table on which specimens may be kept, and above this a shelf containing reference books. The children may be taught to bring to the schoolroom specimens of plants to be left on this table until the teacher has time to identify them. If the teacher is unable to identify any plant, we shall be glad to have it sent to the University for identification. A good-sized specimen should be sent, showing roots, leaves, and flowers or fruit, if possible.

A **terrarium,** which is an enclosed piece of earth on which things may live and grow, has been found very interesting in some of the schoolrooms in New York State. Many kinds of animal life have been housed in terraria. The writer has seen salamanders, toads, snakes, butterflies, caterpillars, beetles, rabbits, hens, guinea pigs, and kittens, in terraria in different schools. Children have been allowed to watch the animal life during leisure hours.

A live examination

Aquaria have not been very successful in most schools, but any teacher can use to advantage battery jars, or even mason fruit-cans, in which aquatic forms of life may be kept for a limited time.

There should be opportunity for **gardening,** on however small a scale. The gardening connected with the rural school might well have relation to the planting of the grounds with some of the native vines and shrubs that can be found along the waysides and in the woods. There should be some experimental work that will have relation to farm interests. Corn, potatoes, a plat of alfalfa, or the like, will lead to observation of the home crops.

For the cultivation of a large piece of ground for children's gardens it is well to buy the seeds in bulk. Some of the older children will enjoy putting them in packets and marking them. The teacher, with some of the children, might estimate the number of lineal feet to be planted with each kind of seed. If the teacher does not know the quantity needed for this estimate the seedsman will tell her.

Every boy and girl should have a vegetable garden at home. Later in the year a special leaflet on gardening will be sent to all rural schools in which this work will be discussed.

One of the greatest needs in the country school to-day is that boys and girls should have an opportunity to become ready readers. Interest in **good books** will open up the world in far-reaching ways and will give a resource for the future that all boys and girls in the country should have. It is not necessary that there should be many books, but the rural library should be well chosen and should contain a few works of history, travel, poetry, and fiction. The books should be chosen according to the age of the pupils. There should be a few good reference books in nature study and agriculture, for boys and girls living in the country should have intelligent knowledge of country surroundings. (See page 1309.)

A home garden

It will be well to have the pupils commit to memory at least one good poem during the year. Memorizing verse often develops appreciation of it, and **poetry** should be a part of the education of every individual.

A most valuable way of arousing the interest of young persons in any new work is to have **exhibitions**. There is educational value in such endeavor, as the children nearly always make their very best effort in preparing the individual exhibits, and they have opportunity to compare their work with that of other pupils. The small school exhibits are doubtless as valuable as any, and the children should be encouraged to prepare for them. An exhibit of fruit or corn or of the eggs and feathers of poultry, or a general nature-study exhibit, will bring about a broader interest than will many formal lessons along agricultural lines. Often schools prepare exhibits for the county fair, and some for the State fair. Many send exhibits to the State College for **Farmers' Week.** This year we should like one nature-study exhibit, and also two ears of corn, from each rural school in New York State. (See pages 1493 to 1508.) These should be sent to Ithaca by January 31, addressed to the Department of Rural School Education, College of Agriculture, Ithaca, New York.

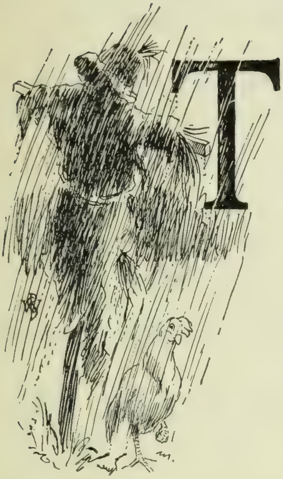
There should be at least one **field trip** each year, in which the children have an opportunity to share out-of-door experiences with the teacher. No matter how little knowledge of nature any of the group may have, the trip will be worth the while. In the springtime many specimens of plant life can be collected for future discussion at school. In winter a short trip into the snow-covered fields or woodland will give joys that will never be forgotten. And autumn is, perhaps, best of all, with the spirit of harvest over the land, the golden pumpkins in the field, the falling of the leaves, and the stores of nuts that delight both the red squirrel and the boys and girls.

A Saratoga county school

CORN DAY

(Friday, December 4, 1914)

Edward M. Tuttle



THERE was very widespread interest in Corn Day last year among the schools of the State. This is an annual celebration held on the first Friday in December of each year, at which time it is customary for rural schools to spend a part of the day in the study of corn — the most important cereal crop of New York State. It has been suggested at times that a sufficient number of "Corn Days" have been held, and that some other crop should be considered. We feel, however, that there should always be a Corn Day in the schools of the State, and that its celebration should become permanent. In this way it will be a very definite contribution to the rural school life; and so much may be learned regarding the corn plant and its products that there is little danger of wearisome repetition, especially since Corn Day comes but once a year.

The subject of Corn Day should be discussed with the children early in the fall, and preparations should be made for holding some simple exercises and an exhibition of seed corn at the school on the first Friday in December. The children may be easily interested in the important matter of improving the quality and yield of the corn crop in the locality, which can be brought about by a selection of more nearly perfect seed ears and a more thorough understanding and practice of good cultivation.

The school exhibition should represent the selective effort of the children, based on their study prior to Corn Day of the characteristics of a good seed ear of corn. When making such a study in the schoolroom it would be well to have before the children sample ears of corn that will show the various points to be considered. It is often valuable to have a poor ear to contrast with a good one, in order to emphasize the essential characteristics. Following is a statement prepared by Professor Gilbert giving the points to be considered in selecting the corn:

Shape of ears.— A perfect ear of corn should be full and strong in the middle part, indicating a strong constitution. It should retain this size to near the tip and the butt, thus forming as nearly as possible a cylindrical ear.

Butts of ears.— The rows of kernels should extend well down over the butts of the ears, thus giving an ear of better appearance and containing a higher yield of grain. The shank, or part of the stalk that is attached to the ear, should be not too large and coarse. Swelled, open, or badly compressed butts, as well as those having kernels of irregular size, are objectionable.

Tips of ears.— The tips of the ears should be well filled out, indicating a type of corn that will easily mature. The rows of kernels should extend in a regular line to the extreme tip of the ear.

Shape of kernels.— The shape of the kernels is very important They should broaden gradually from tip to crown with edges straight, so that they will touch the full length — and should be wedge-shaped without coming to a point. Kernels of this shape will fit close together and thus insure the highest possible yield of grain that can grow on the cob. If the kernels have this wedge shape, no wide spaces will be found between the rows. Such spaces are always objectionable.

Proportion between corn and cob.— There should be a large proportion of grain as compared with the amount of cob. This will be the case with ears having deep kernels. A large ear does not necessarily indicate a heavy yield of grain, and it is objectionable in that the cob, being large, contains a considerable amount of moisture which, drying out slowly, injures the grain for seed purposes.

Color of grain and cob.— Good corn should be free from admixture. White dent corn should have white cobs and yellow dent corn should have red cobs. Flint corn, with the exception of the red variety, should have white cobs.

Trueness to type or race characteristics.— The ears selected for an exhibit or for breeding purposes should be uniform in size, shape, color, indentation, and size of kernel. They should also be true to the name of the variety.

In connection with Professor Gilbert's statement, we give herewith a score card for ears of corn for seed, and an explanation of the various items. These were prepared by Mr. E. R. Minns.

SCORE CARD FOR EARS OF CORN

1. Maturity and soundness	35
2. Uniformity	20
3. Weight of ear	15
4. Shape of ear	10
5. Shape of kernels	10
6. Tip of ear	5
7. Butt or shank	5
Perfect score	100

1. Maturity means ripeness. It can be told usually by the appearance of the ear of corn and by the the way the ear feels. A mature ear will have the kernels firm on the cob. It will not feel moist in the hand. The cob will not be limber nor the kernels shriveled or shrunken so that the ear will bend very readily under pressure. Only ripe, undamaged ears of corn should be exhibited.

2. Not all the ears of one variety will be exactly alike, but there should be uniformity in color of the kernels, color of the cob, and shape and general appearance of the ears. If mixed with some other variety of corn, the ears will lack this trueness to type. If the variety of corn used has not been well bred, it may be hard to find ten ears that are nearly alike.

3. The weight of an ear of corn can be judged by holding it in the hand and observing its size. One would not expect an ear of a small variety of corn to weigh as much as an ear of a larger variety, but in order to be a good ear it should be heavy for its size. This usually means a large proportion of grain to cob.

4. The shape of the ear will depend much on the variety of corn grown. The length of the ear should be well proportioned for that variety. Moderately long ears, well filled, are more desirable than short, thick ears of the same variety. An ear that tapers very strongly toward the tip is usually deficient in the shape of its kernels and in its weight.

5. Different types of corn have differently shaped kernels. The best dent corn usually has a somewhat wedge-shaped kernel, but not a pointed one. Flint corn has broader kernels than those of dent corn. Pop corn may have either pointed or rounded kernels, according to the variety. In general, the shape of the kernel should be such that the rows fit closely together on the cob and do not leave spaces between them.

6. An ear with the tip end of the cob bare is not a good one to show. Good ears of corn will have the tip well covered with kernels.

7. Ears of dent corn should have the butt of the ear well filled; and a moderate-sized shank is desirable. Some kinds of flint corn have a tendency to grow very large shanks, and the butt of the ear is enlarged so that it is not properly covered with kernels of corn. This is objectionable. Ears of pop corn frequently have butts that taper, and the shank is weak so that the ears may drop off the stalk when ripe. Frequently the best ears of corn will have butts that are symmetrical with the rest of the ear.

Having in mind what constitutes a good ear of corn, the children, in preparing for a Corn Day exhibit, should individually select the most nearly perfect ears that they are able to find either on their own farm or on a neighboring farm in the community. In doing this they are sure to interest the older folk in seed selection, as will be seen from the following letter:

District 10; Town of Canisteo; Steuben County

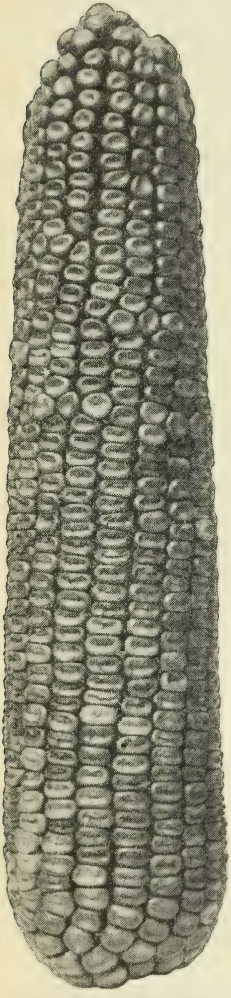
South Canisteo, New York, February 11, 1914

Dear Mr. Tuttle:

I am writing to thank you for the leaflet that you sent last. It was very interesting. I will tell you what a time I had getting an ear of corn for Corn Day. My father had about two acres of corn, but it did not turn out very well, so I went in our neighbor's field for corn, and their corn was not much better. Then I went down the road about a half mile, and stopped at a place where I knew the people. I asked them if they had any corn. They said they did. Then I asked them if I could have an ear of flint and an ear of dent. They said they only had the flint ears of corn. They let me have my pick of nearly a half corn crib full. I told them that I wanted a good ear of corn, that I wanted the kernels in straight rows close together, and that I wanted the kernels to come around the ends of the corn. I selected the ear of corn that I thought was best, and then I told them all about Corn Day. Watching and hoping for your next leaflet,

Yours very friendly,

CLARA M. ALLEN



State prize, Farmers' Week, 1914

Often the boys and girls have grown some corn of their own during the year; and if the ear that appears to them most nearly perfect comes as a result of their own effort in producing it, so much the more credit will be theirs.

It is always interesting and valuable to hold some kind of simple exercises in connection with the exhibit on Corn Day, and to have the schoolroom decorated with emblems of harvest time. Following is a simple program, sent to us by one of the schools in the State after the Corn Day celebration last year. It offers a good combination of collective and individual effort on the part of the children, and of contributions by outsiders. Each school, of course, will be subject to local conditions that will necessitate a modification of such a program; and such modification should always be made in order to make the program as fully as possible a definite expression of local sentiment.

CORN DAY PROGRAM

Song — America	School
Recitation — Lines from Hiawatha	School
Discussion — The Corn Plant	Led by Principal
Recitation — Farmer Nick's Scarecrow	A pupil
Song — God's Gift in Nature	School
Reading — Varieties of Corn	A pupil
Reading — Preparation of Ground, Planting and Cultivating Corn	A pupil
Recitation — This Way	A pupil
Reading — Corn Pests	A pupil
Reading — Harvesting Corn	A pupil
Recitation — Baby Corn	A pupil
Address — Silos and Ensilage	A visiting farmer
Address — Corn Crop in the United States	A visiting farmer
Reading — How to Know a Good Ear of Corn	A pupil
Judging Corn Exhibit	Committee of three farmers
Song — Columbia, the Gem of the Ocean	School

As a culmination of the Corn Day activities, it has been customary for the rural schools that celebrate Corn Day to send to the State College of Agriculture the best ears of corn selected from the local exhibit. A year ago we asked that this be done, and received an ear of flint corn, or an ear of dent corn, or both, from eight hundred and ninety-seven schools in all parts of the State. This corn was properly labeled before it was sent, and on reaching the College it was carefully stored and arranged for exhibition during Farmers' Week in February. The exhibition of a definite piece of work from so many rural schools created much interest at the College last winter, and it was felt to be well worth while. We shall make arrangement for a similar exhibition next Farmers' Week, asking that each rural school holding a Corn Day exhibit send us the best ear of flint or dent corn, or both, to represent the school in the general exhibition at the State College of Agriculture. The ears should be labeled, using the following form:

........................County
District number...........Town of.................
..........................Teacher
Post office.............................., New York
...................., District Superintendent

This should be neatly printed on a strip of plain white paper, one inch wide, which should be long enough to wrap around the middle of the ear of corn and be pasted at the back. The label should be so placed that, when the butt of the ear of corn is held in the hand, the printing will be right side up. After the ears are labeled they should be wrapped carefully and mailed by parcel post to

Edward M. Tuttle
College of Agriculture
Ithaca, New York

as soon after Corn Day as convenient, and not later than January 31.

Further details regarding the exhibition at the College and the awarding of prizes will be given in the November leaflet for boys and girls. Each county will be awarded two prizes, one for the best ear of flint corn and one for the best ear of dent corn. In addition to the county prizes there will be two prizes from the State as a whole, one for each type of corn. These prize ears will be returned to the schools from which they came, as was done last year.

The ears of corn not winning a prize will be given away to the guests at Farmers' Week who desire to take them. This proved a very interesting feature of the exhibition last year, and many ears of corn were taken by farmers and others, who agreed to write to the schools from which the ears came.

Following are two letters from children in the schools, the first telling of the disposal of the county prize ear of corn that was returned to the school, the second telling of the destination of an ear of corn that was taken by an interested visitor:

District 4; Town of Sullivan; Madison County
Canastota, New York, May 7, 1914

Dear Mr. Tuttle:

I am going to tell you about the corn that was sent from our school. On Corn Day several children brought corn to the school to be sent to Cornell. Miss Wager, our teacher, wrapped two of the best ears safely in a small box and sent them to you, not expecting to receive any prize for the corn.

You can't imagine how surprised we were when we found that the dent ear had won the Madison County prize.

Good care has been taken to preserve it, and about a week ago we planted a few kernels to test it. It is now up. Several of the boys have volunteered to plant the rest of the kernels, and take the best care the coming year. We hope that by next fall we will have some more good corn to send you.

Your friend,
ANDREW ANDERSON

District 8; Town of Grafton; Rensselaer County

Cropseyville, New York, May 28, 1914

Dear Mr. Tuttle;

Our corn that we sent to Farmers' Week did not take a prize, and we have heard nothing at all about the flint ear, which was thought to be the better of the two we sent by the farmers around here.

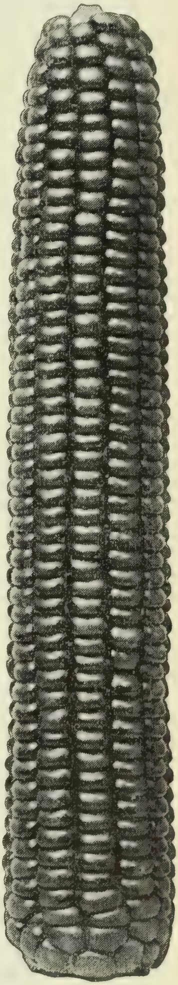
A school-teacher in West Danby, Tompkins county, whose name is Edwin S. Gay, jr., took home the ear of dent corn sent by our school, and if it tests at least $66\frac{2}{3}$ per cent they are going to plant it, and when it grows Mr. Gay has promised to write and tell us about it.

When my teacher received the letter from Mr. Gay we children were all very much pleased, and we hope the corn will prove worthy of the care taken of it.

This is my third letter this year, and I shall wait anxiously for a prize picture.

Your country friend,
ETTA CRANDALL

There is one feature of the Corn Day work that it is desirable to follow from year to year, and this is the succession of the prize ears of corn. The schools to which the prize ears were returned last year agreed to have the seed from these ears planted and cared for by some one in the district. The chances are that the product from these good ears may be more nearly perfect than other corn in the district, and will represent the school again this year. If such is the case we desire that the ear of corn shall be specially marked in some way showing that it is the product of last year's prize ear. In order that such ears may not escape our notice, we would suggest that a piece of red string or ribbon be tied around the ear just above the label, and that a letter of explanation be sent to us at the time the ear is forwarded.



State prize, Farmers' Week, 1914

It may be of interest to the teachers to see a list of the schools in the State winning the county and state prizes at the last Farmers' Week. Such a list is given following this article.

The points to be remembered in connection with Corn Day are:

1. Make preparations during the fall
2. Study in school the points to be considered in selecting seed corn

3. Arrange a program for Corn Day, Friday, December 4, 1914
4. Invite older persons in the community
5. Decorate the schoolroom
6. Have an exhibition of ears of corn selected by the pupils
7. Have this corn judged, selecting the best ear of flint and the best ear of dent
8. Properly label these ears as directed
9. Wrap them carefully and send them by parcel post on or before January 31 to

Edward M. Tuttle
College of Agriculture
Ithaca, New York

PRIZE LIST

Corn Exhibition, Farmers' Week, 1914

Albany County

Flint corn — District 7, Town of Bethlehem. Rose B. Rothaupt, teacher. Feura Bush, New York. N. Sweet, district superintendent.

Allegany county

Dent corn — District 1, Town of Rushford. Louisa D. Myers, teacher. Rushford. G. W. d'Autremont, district superintendent.
Flint corn — District 7, Town of Caneadea. Jessie M. Dodge, teacher. Caneadea. G. W. d'Autremont, district superintendent.

Broome County

Dent corn — District 5, Town of Kirkwood. Merniah Hickey, teacher. Binghamton. J. E. Hurlburt, district superintendent.
Flint corn — District 2, Town of Vestal. Bernice Jones and Myrtle Howard, teachers. Vestal. Miss M. L. Watrous, district superintendent.

Cattaraugus County

Dent corn — District 3, Town of Leon. Maude English, teacher. Cattaraugus. E. A. Stratton, district superintendent.
Flint corn — District 3, Town of South Valley. Marjorie Backus, teacher. Onoville. E. A. Stratton, district superintendent.

Cayuga County

Dent corn — District 1, Town of Fleming. Minnie Salisbury, teacher. Auburn, R. D. Mrs. Anna M. Kent, district superintendent.
Flint corn — District 1, Town of Fleming. Minnie Salisbury, teacher. Auburn, R. D. Mrs. Anna M. Kent, district superintendent.

Chautauqua County

Dent corn — District 3, Town of Pomfret. E. D. Crouch, teacher. Fredonia. L. W. Swain, district superintendent.
Flint corn — District 3, Town of Pomfret. E. D. Crouch, teacher. Fredonia. L. W. Swain, district superintendent.

Chemung County

Dent corn — District 2, Town of Catlin. Ralph Upson, teacher. Horseheads, R. 1. W. C. King, district superintendent.
Flint corn — District 2, Town of Catlin. Ralph Upson, teacher. Horseheads, R. 1. W. C. King, district superintendent.

Chenango County

Dent corn — District 2, Town of McDonough. Laura Gifford, teacher. Oxford. J. S. Childs, district superintendent.
Flint corn — District 19, Town of Greene. Lena E. Merrell, teacher. Greene. Miss J. I. Schenck, district superintendent.

Clinton County

Flint corn — District 3, Town of Schuyler. Nora Crowley, teacher. Morrisonville. O. A. Wolcott, district superintendent.

Columbia County

Dent corn — District 4, Town of Taghanic. Lucy M. Benson, teacher. West Taghanic. E. A. Smith, district superintendent.
Flint corn — District 1, Town of Canaan. Ella R. Abel, teacher. Canaan. S. B. Smith, district superintendent.

Cortland County
Flint corn — District 12, Town of Cortlandville. M. Zella Gardner, teacher. Cortland.
C. W. Ellis, jr., district superintendent.

Delaware County
Flint corn — District 12, Town of Tompkins. Elizabeth Fletcher, teacher. Granton.
Miss Lillian Reichard, district superintendent.

Dutchess County
Dent corn — District 4, Town of Hyde Park. Florence Van Keuren, teacher. Hyde Park.
Miss Clara E. Drum, district superintendent.
Flint corn — District 10, Town of East Fishkill. A. M. Hawks, teacher. Hopewell Junction.
F. L. Haight, district superintendent.

Erie County
Dent corn — District 10, Town of Aurora. Melissa K. Fox, teacher. East Aurora.
W. E. Pierce, district superintendent.
Flint corn — District 11, Town of Aurora. Frank G. Myers, teacher. West Falls.
W. E. Pierce, district superintendent.

Essex County
Flint corn — District 10, Town of Jay. Tunis M. Smith, teacher. Upper Jay.
Miss M. J. Prime, district superintendent.

Franklin County
Dent corn — District 4, Town of Malone. May Carlin, teacher. Malone.
Eugene L. Moe, district superintendent.
Flint corn — District 4, Town of Malone. May Carlin, teacher. Malone.
Eugene L. Moe, district superintendent.

Fulton County
Flint corn — District 6, Town of Perth. Charlottie Shattuck, teacher. Hagaman, R. 2.
C. E. Van Buren, district superintendent.

Genesee County
Dent corn — District 1, Town of Pavilion. Elam C. Curtis, teacher. LeRoy.
T. A. Clement, district superintendent.
Flint corn — District 1, Town of Pavilion. Elam C. Curtis, teacher. LeRoy.
T. A. Clement, district superintendent.

Greene County
Dent corn — District 9, Town of Greene. Mrs. E. R. Hoose, teacher. Greenville.
R. M. McNaught, district superintendent.
Flint corn — District 12, Town of Catskill. Julia M. Vedder, teacher. Leeds.
T. C. Perry, district superintendent.

Hamilton County
Flint corn — District 5, Town of Hope. Sadie Conway, teacher. Hope Falls.
C. B. Hanley, district superintendent.

Herkimer County
Flint corn — District 2, Town of Herkimer. Lela M. Small, teacher. Ilion.
C. B. Keller, district superintendent.

Jefferson County
Flint corn — District 23, Town of Clayton. Ruth O. Phillips, teacher. St. Lawrence.
T. B. Stoel, district superintendent.

Lewis County
Flint corn — District 2, Town of Grieg. Josephine Haner, teacher. Lyons Falls.
Miss Ruth M. Johnston, district superintendent.

Livingston County
Dent corn — District 10, Town of Springwater. Mae E. Brown, teacher. Springwater.
J. F. Smith, district superintendent.
Flint corn — District 5, Town of Livonia. A. E. Dwyer, teacher. Livonia.
J. F. Smith, district superintendent.

Madison County
Dent corn — District 4, Town of Madison. Laura B. Wager, teacher. Canastota, R. 1.
Daniel Keating, district superintendent.
Flint corn — District 2, Town of Madison. Jessie E. Pilbeam, teacher. Madison.
H. C. W. Kingsbury, district superintendent.

Monroe County
Dent corn — District 6, Town of Perinton. Minnie C. Gibke, teacher. Victor.
M. B. Furman, district superintendent.
Flint corn — District 6, Town of Hamlin, G. Fern Brooks, teacher. Hamlin.
Fred W. Hill, district superintendent.
(Also State Prize)

Montgomery County

Dent corn — District 8, Town of Canajoharie. Ellen Vaughan, teacher. Canajoharie.
N. B. Alter, district superintendent.
Flint corn — District 7, Town of Palatine. Mrs. Nannie Shults, teacher. Fort Plain, R. 4.
N. B. Alter, district superintendent.

Nassau County

Dent corn — District 1, Town of North Hempstead. May E. Balch, teacher. Westbury.
J. S. Cooley, district superintendent.

Niagara County

Dent corn — District 10, Town of Newfane. Vesta McKee, teacher. Burt.
W. D. Wisner, district superintendent.
(Also State Prize)
Flint corn — District 7, Town of Newfane. Clara I. Hayden, teacher. Lockport, R. D.
W. D. Wisner, district superintendent.

Oneida County

Dent corn — District 15, Town of Vienna. Emily E. Beeman, teacher. Blossvale, R. 1.
F. E. Mathewson, district superintendent.
Flint corn — District 2, Town of Deerfield. Harriet M. Small, teacher. 17 Hager Street, Utica.
R. P. Snyder, district superintendent.

Onondaga County

Dent corn — District 1, Town of Van Buren. Silas F. Parry, teacher. Baldwinsville.
Manford D. Green, district superintendent.
Flint corn — District 1, Town of Van Buren. Silas F. Parry, teacher. Baldwinsville.
Manford D. Green, district superintendent.

Ontario County

Dent corn — District 11, Town of Farmington. Clara B. Creeger, teacher. Palmyra.
W. A. Ingalls, district superintendent.
Flint corn — District 12, Town of Farmington. Beatrice E. Early, teacher. Macedon.
W. A. Ingalls, district superintendent.

Orange County

Dent corn — District 13, Town of Warwick. Aimee Minturn, teacher. Warwick.
O. Eichenberg, district superintendent.
Flint corn — District 13, Town of Warwick. Aimee Minturn, teacher. Warwick.
O. Eichenberg, district superintendent.

Orleans County

Dent corn — District 10, Town of Barre. Mary E. Randall, teacher. Albion, R. 3.
Miss Cora V. Luttenton, district superintendent.
Flint corn — District 1, Town of Ridgway. Ethie C. Crouch, teacher. Medina.
Miss Luella P. Hoyer, district superintendent.

Oswego County

Dent corn — District 1, Town of Mexico. Vesta Spicer, teacher. Mexico.
C. I. Kingsbury, district superintendent.

Otsego County

Dent corn — District 6, Town of Edmeston. Mrs. Hazel Gardner, teacher. South Edmeston.
Floyd R. Thayer, district superintendent.
Flint corn — District 8, Town of Otsego. Maude A. Eldred, teacher. Cooperstown.
J. B. McManus, district superintendent.

Rensselaer County

Dent corn — District 10, Town of Pittstown. Ella E. Donahue, teacher. Valley Falls, R. 2.
Mrs. C. B. Clark, district superintendent.
Flint corn — District 1, Town of East Greenbush. Mary McDonough, teacher. East Greenbush.
G. W. Patterson, jr., district superintendent.

Rockland County

Dent corn — District 10, Town of Ramapo. Martha Woytisek, teacher. Pomona.
G. W. Miller, district superintendent.

St. Lawrence County

Flint corn — District 13, Town of Brasher. Agnes M. White, teacher. Brasher Falls.
M. A. Hallahan, district superintendent.

Saratoga County

Dent corn — District 13, Town of Clifton Park. Katherine H. Doody, teacher. Ushers.
A. A. Lavery, district superintendent.
Flint corn — District 9, Town of Stillwater. Margaret Folts, teacher. Mechanicville, R. D.
A. A. Lavery, district superintendent.

Schenectady County

Flint corn — District 5, Town of Princetown, Margaret Duryee, teacher. Pattersonville.
James Wingate, district superintendent.

Schoharie County
Dent corn — District 5, Town of Middleburgh. Ernest K. Smith, teacher. Middleburgh.
W. E. Van Wormer, district superintendent.
Flint corn — District 11, Town of Fulton. L. Chapman, teacher. Breakabeen.
W. E. Van Wormer, district superintendent.

Schuyler County
Dent corn — District 15, Town of Hector. Martha Norris, teacher. Burdett.
Miss Alberta Spaulding, district superintendent.
Flint corn — District 8, Town of Hector. Kathleen Miller, teacher. Bennettsburg.
Miss Alberta Spaulding, district superintendent.

Seneca County
Dent corn — District 3, Town of Fayette. Mary A. Kime, teacher. Geneva, R. 5.
Charles B. Earl, district superintendent.
Flint corn — District 3, Town of Fayette. Mary A. Kime, teacher. Geneva, R. 5.
Charles B. Earl, district superintendent.

Steuben County
Dent corn — District 3, Town of Lindley. John C. Rose, teacher. Lindley.
Levi R. Tubbs, district superintendent.
Flint corn — District 4, Town of Canisteo. Emma Ellington, teacher. Cameron.
H. M. Brush, district superintendent.

Suffolk County
Dent corn — District 17, Town of Southampton. G. G. Bailey, teacher. Quogue.
C. H. Howell, district superintendent.
Flint corn — District 2, Town of Easthampton. Margaret Swobe, teacher. Wainscott.
C. H. Howell, district superintendent.

Sullivan County
Dent corn — District 1, Town of Callicoon. Julia A. McGuinn, teacher. Jeffersonville.
C. S. Hick, district superintendent.
Flint corn — District 1, Town of Callicoon. Julia A. McGuinn, teacher. Jeffersonville.
C. S. Hick, district superintendent.

Tioga County
Dent corn — District 4, Town of Nichols. Julia Bouille, teacher. Owego.
H. T. Whittemore, district superintendent.
Flint corn — District 1, Town of Spencer. Edna Messenger, teacher. Hagadorn Mills.
M. D. Goodrich, district superintendent.

Tompkins County
Dent corn — District 15, Town of Lansing. Jessie K. Spaulding, teacher. Ithaca.
Miss Hattie K. Buck, district superintendent.
Flint corn — District 19, Town of Caroline. H. L. Doty, teacher. Brookton.
J. D. Bigelow, district superintendent.

Ulster County
Dent corn — District 13, Town of Rochester. Elnora Neimyer, teacher. High Falls, R. D.
J. M. Schoonmaker, district superintendent.
Flint corn — District 6, Town of Gardner. B. J. Terwilliger, teacher. New Paltz.
J. U. Gillette, district superintendent.

Warren County
Dent corn — District 15, Town of Queensbury. Frances Harris, teacher. Glens Falls.
Franklin F. Gunn, district superintendent.
Flint corn — District 6, Town of Queensbury. Lida H. Burton, teacher. Lake George.
Franklin F. Gunn, district superintendent.

Washington County
Dent corn — District 4, Town of White Creek. Anna Johnson, teacher. Eagle Bridge.
F. H. Rich, district superintendent.
Flint corn — District 9, Town of Jackson. Mary E. O'Donnell, teacher. Cambridge, R. D.
F. H. Rich, district superintendent.

Wayne County
Dent corn — District 12, Town of Butler. Ruth Turner, teacher. South Butler.
Miss Ida Cosad, district superintendent.
Flint corn — District 4, Town of Arcadia. Sarah Southard, teacher.
Mrs. Helen C. Andrews, district superintendent.

Wyoming County
Dent corn — District 9, Town of Covington. Harold Altoft, teacher. Pavillion, R. 3.
G. H. Stratton, district superintendent.
Flint corn — District 17, Town of Bennington. M. Fitzgerald, teacher. Cowlesville.
E. D. Jones, district superintendent.

Yates County
Dent corn — District 5, Town of Torrey. Edith Depew, teacher. Dresden.
J. F. Bullock, district superintendent.
Flint corn — District 3, Town of Starkey, Mrs. A. J. Drummond, teacher. Dundee.
J. F. Bullock, district superintendent.

THE EXHIBITION OF RURAL SCHOOL WORK[8]

ANNA BOTSFORD COMSTOCK

A nature-study exhibit from rural schools is certainly as interesting as it is encouraging, for the place where nature study can do its greatest good is surely in the rural schools. Such an exhibit brought cheer to the Cornell nature-study contingent during Farmers' Week, 1914.

Farmers' Week is the one week of the year when the farmers of New York State really own the College of Agriculture at Cornell University. Hundreds of them gather at these meetings and regular instruction is suspended. Professors and students all are hosts to the visitors that flock in from the farms. There are also lectures by experts and conferences of special organizations, all conducing to make this a week of great benefit to those who wish to learn the latest ideas about farming.

During this week in 1914 the corn exhibit from the rural schools was held. For a year the Department of Rural School Education, through correspondence and the Cornell Rural School Leaflets, had been organizing and planning the corn exhibit for this year, with the remarkable result that eight hundred and ninety-seven schools responded with one of the most beautiful and gratifying exhibits that the writer has ever seen.

It was as late as December when the editors of the Cornell Rural School Leaflet sent letters to the district superintendents asking them whether they had any nature-study material to send in for Farmers' Week. Since nothing had been said of this before, a large amount of material was not expected, but it came in in overwhelming quantities. In fact, there was so much of it that there was not sufficient space allowed to properly mount it for exhibition; and we were all delighted and surprised at the general excellence and the scope of the work.

There were several collections of grains in boxes and in vials, not only of a grain itself, but also of the feeds and flours made from it, and, in some instances, the commercial foods made from the grains. In other instances, the grains were classified according to the domestic animals to which they are fed. There were some tastefully arranged heads of grain mounted on cards. One large card gave a very complete record of the corn plant, showing the stalk and sections, the roots, including the brace roots, the leaf, the tassel, the husk, the ear — the latter also in cross section — the kernel, and the seedling. There was also an illustrated account of the germ and food in the seed.

There were several collections of weed seeds. In some cases, these illustrated the weeds of special crops. In some cases, the weed was mounted, showing its seeds and methods of distribution. There was one collection of three hundred vials containing seeds properly labeled.

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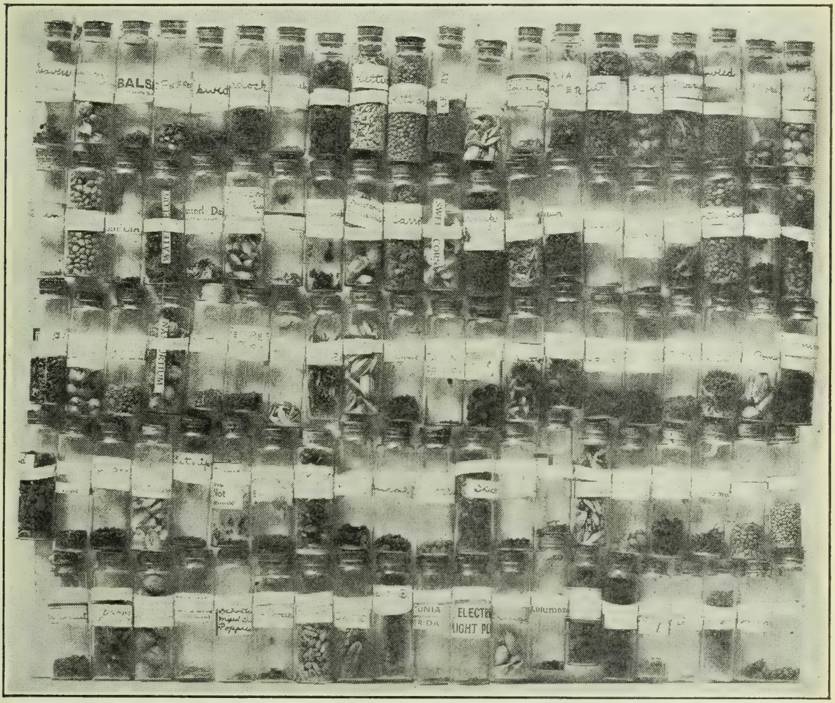
[8] Published in *The Nature Study Review*, May, 1914.

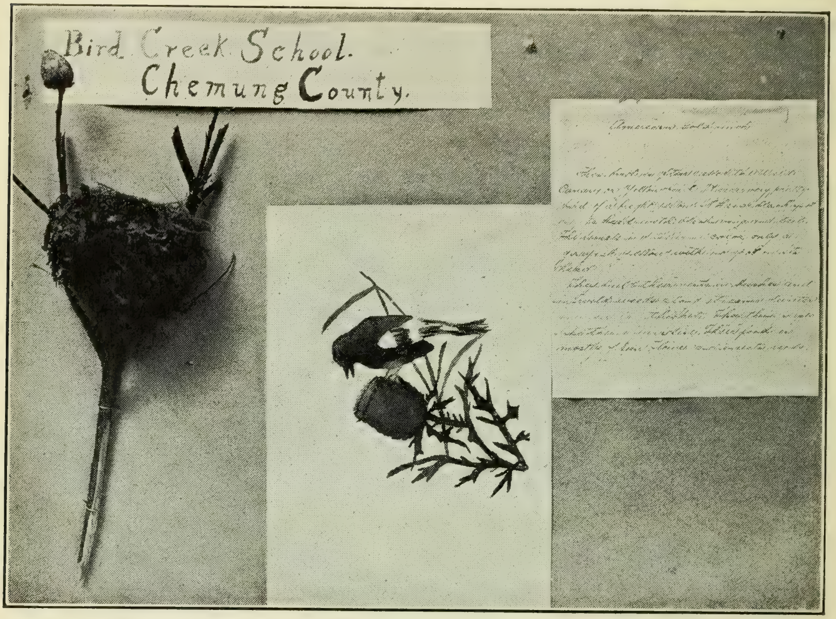
On the whole, the exhibits of tree study were most complete and satisfactory. There were several sets of bark, with cross sections and lengthwise sections of the wood, all carefully labeled. There were also many large collections of twigs accurately determined; sixty-three species were shown on one card. And, best of all, there were collections of mounted specimens showing wood in cross and lengthwise sections, the bark, the leaves, and the fruit. There were several complete collections of our native evergreens and one particularly excellent series of our native oaks. There were also numerous collections of autumn leaves, with colors well preserved, each leaf being specifically labeled. One cross section of a tree was correlated with history. A pin, to which a paper was attached giving an important historical occurrence, was set in the ring of growth of the year in which this happened. This covered about fifty years of history and it attracted much attention.



Mount of seeds

The plant collections were numerous. One was especially well mounted, containing sixty-three specimens of common field plants. There was also a collection of mosses, lichens, and ferns.

The bird work was most attractive. There were many collections of birds' nests, although they were not very accurately named. But there were two collections with each nest mounted on a card, on which was placed also a water-color drawing of the bird, made by the pupil, and a little essay on the bird's habits. This seemed to us an ideal exhibit. There were, besides, many water-color pictures of birds and also many essays on their habits, and some attractive and carefully recorded bird calendars.



A good bird mount

The domestic birds came in for a large share of attention. There were several exhibits of feathers of domestic fowls arranged according to their position on the bird's body, as shown on the opposite page. There were so many of these that a poultry expert was sent for to judge them. There were also other collections of feathers of all domestic birds, and here and there a partridge tail or wing feather put in and properly labeled. There were many essays on the care of fowls, and some particularly neat scrapbooks containing descriptions and pictures of many varieties of domesticated birds. The best of these showed thirty-five kinds of fowls and several varieties of ducks, geese, and turkeys.

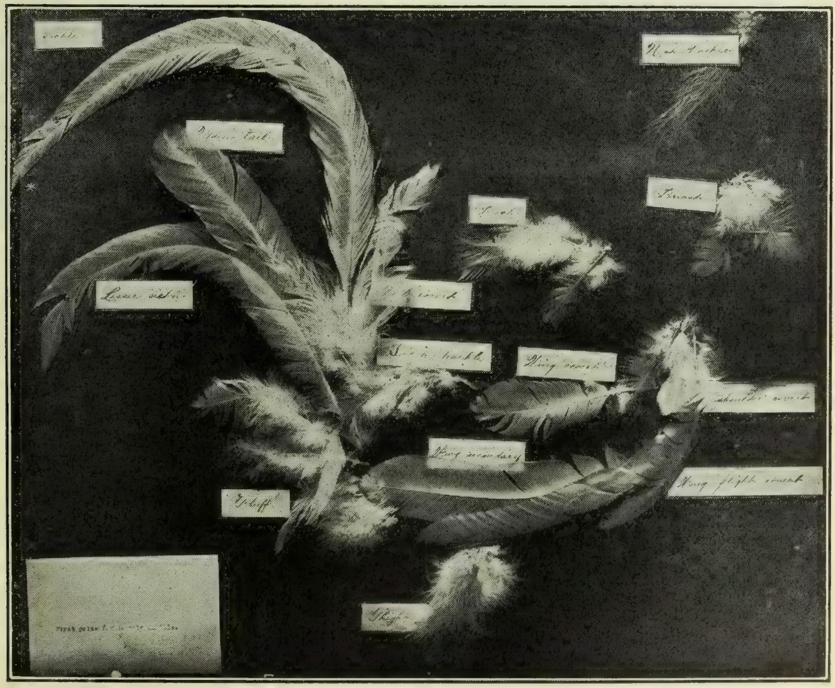
There were several collections of mounted insects, a few of them remarkably large for a rural school. There were also pencil drawings of butterflies, which were very good indeed. From an economic standpoint, one exhibit was truly remarkable. It consisted of a box containing twelve thousand egg-masses of the apple-tree tent caterpillar, collected by the pupils of one rural school.

There were several exhibits of textiles. The picture on the next page shows the best of these, which was a remarkably complete wool collection. There were several sets of drawings of cattle, which were very good and which were accompanied by essays on the stock.

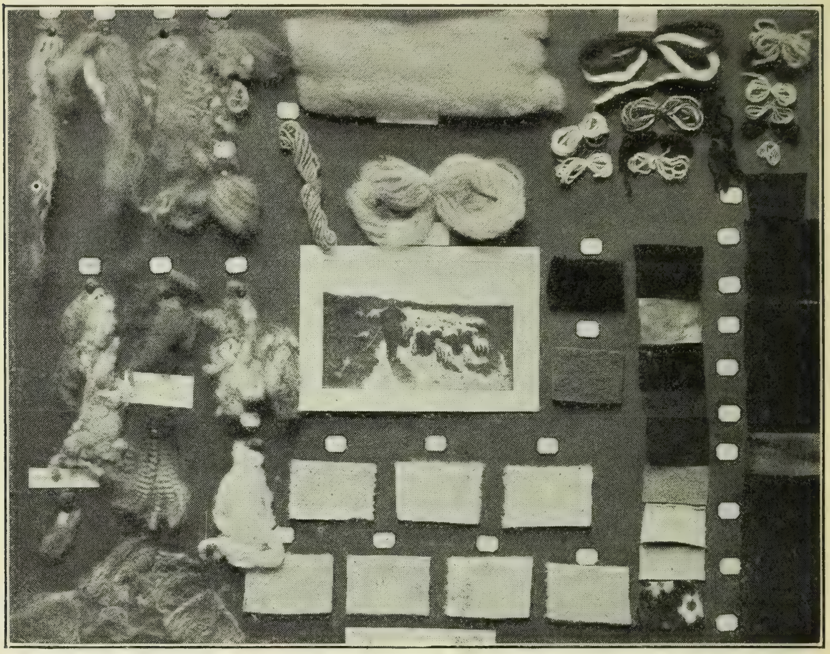
There was only one collection of pebbles and stones. There were several collections of water-color drawings of flowers, and also of landscapes, which were original and interesting. There were two good relief maps — one of the United States, and one very remarkable map of New York State.

A very well-constructed terrarium, made entirely by the children, was sent by one school. It had a frame of wood, sides of glass, and cover of wire netting.

Of special interest to the writer were three squirrel nests, made of the finely shredded bark of wild grape, each a compact mass nine or ten



Feather mount, showing relative position of different kinds inches in diameter, with a cosy pocket inside just large enough for one little creature. One of these was labeled " Nest of the Flying Squirrel." And although the annals of flying squirrel literature, so far as I can discover, make no mention of such a nest, Miss Mathilda Schelgel, a very reliable authority, assures me that these squirrels often make such nests, high up in or above grapevines.



Wool and its products

Some of the collections sent for the exhibit had been shown at county fairs and had received prizes. It is encouraging that the agricultural fairs are helping this work. From every point of view, this exhibit was gratifying and gives sure hope for advancing excellence and usefulness of the rural schools in New York State.

Editors' Note.— If teachers will try to interest boys and girls in preparing a few exhibits in nature study and elementary agriculture each year, they will find that a great deal of valuable information will result, and a live interest in farm life will be developed. Schools that send exhibits for the first time should not attempt too much. A simple piece of work well done will be satisfactory and will lead to a larger undertaking the next year. Suggestions for definite work are given on the opposite page.

THE GENERAL EXHIBIT FOR FARMERS' WEEK, 1914–1915

THE EDITORS

Since a very large number of schools are now taking part in the rural school exhibition held during Farmers' Week at the New York State College of Agriculture, it seems best to give some directions as to the kind of material that should be sent. Last year a few articles of value were lost, and we should like to avoid the responsibility of personal treasures, since very simple and inexpensive things are often far more valuable for this work. We would therefore suggest the following for exhibition, and prizes will be given for the best in each class:

1. One mount of tree specimens. See page 154.
2. One bird's nest, well mounted, with description and drawing of the species of bird to which it belonged.
3. One mount of poultry feathers, accompanied by such description and information regarding these feathers as will present the knowledge gained from the study of them.
4. One collection of herbaceous plants, collected and mounted by the children. This should be prepared by the school for a school prize.
5. One mount of grains or grasses, with informational matter that will show knowledge of the specimens mounted. Prepared by the school, not by an individual.
6. One drawing of natural scenery.
7. One drawing of farm animals.
8. One bird calendar.
9. One weather record.
10. One sample of stocking darning.
11. One sample of napkin hemming.
12. One kitchen apron for a girl twelve to fourteen years of age, which will be judged as to suitability of material, color, design, and workmanship.
13. One attractive and serviceable bureau cover.

Should any teacher be willing to help the boys and girls to receive the educational opportunity that preparation for an exhibit always gives, we would ask that the rule regarding one exhibit in each group be observed in order that this exhibition may be conducted as efficiently as possible. We realize that the competition will not be entirely satisfactory, because some schools will have a much better opportunity to prepare an exhibit than others; but we shall appreciate every effort on the part of the schools and the teachers, and shall send a letter of appreciation to every school from which an exhibit is received.

We do not want more than *one exhibit* in each of the groups mentioned above, from any school. If several children in one rural school should prepare specimens in any one group, it would be well to have an exhibition held at the school building, asking local judges to make decision as to which specimen is the best. Such a plan will decrease expense of mailing, and will also leave specimens of some good work at the school building or in the children's homes. Many schools may wish to send an exhibit from each of the above thirteen groups, and this will be satisfactory, but no two exhibits of the same kind should be sent from any one school.

AGRICULTURAL CONTESTS

THE EDITORS

During the past year there has been great interest and activity in contest work for boys and girls in New York State. We are glad of this, for such contests are of undoubted educational value. Our desire now is that the contest work may be organized and directed by the established educational authorities.

In States in which natural history and elementary agriculture are not as yet incorporated into the school day, agricultural clubs are being used as a means of creating sentiment favorable to teaching boys and girls in terms of their rural environment; in other words, the movement is primarily for propaganda work, and is so recognized. In New York State, natural history and elementary agriculture are very generally recognized, and are now being taught to a greater or less extent in a large proportion of the schools. More and more they are becoming a part of the daily school life.

It is hoped, therefore, that competitions among boys and girls in this State may serve as a supplement to the organized school work in natural history and elementary agriculture, contributing in a very definite way elements that can be attained by no other means — such as the ability to understand and follow a definite set of rules, the good result obtained by work in competition and in relation with others, and the very essential element of earnest, responsible effort. These contests should be organized and conducted by superintendents of schools and teachers, who, because of the permanence of their office and their training for educational work, are best fitted to direct the boys and girls. These persons will be able to make the best use of aid by agricultural experts, or by any public-spirited man or woman who may have a definite contribution to give to a work that is educational and important in the development of a better country life.

In many supervisory districts in New York State, agricultural contests for children are being worked out in a wholesome, educational way.

Mr. Ray P. Snyder, Superintendent of Schools in District No. 1, Oneida county, sent us his point of view on this subject, and we asked permission to publish his communication. During the year we hope to publish similar reports from many other superintendents of rural schools.

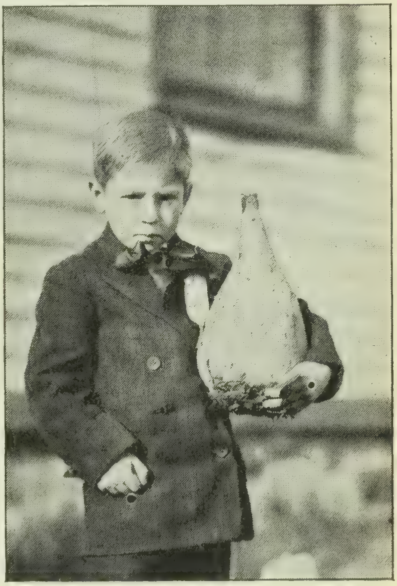
AGRICULTURAL CONTESTS A BASIS FOR SCHOOL WORK

Ray P. Snyder

(Superintendent of Rural Schools, District No. 1, Oneida county)

Agricultural contests conducted through the school organization must furnish a basis for school work. If they fail in this they have no place in the school. The question naturally arises, "What is school work?" For the purpose of this discussion, let us say that it is the work done in or through the school which has for its object the training of the child mind and the molding of the child character. For the accomplishment of these ends and to make the work as uniform as possible, a school syllabus has been prepared by persons who have given much thought and study to educational questions.

That agricultural contests can be a very valuable aid to the work laid down in the syllabus, and at the same time furnish the best kind of help for training the child mind and character, has been proved. It is of vital importance, however, that the district superintendent, the teacher, and others engaged in directing the contests, keep these aims in mind. Any contest that has for its chief object the mere winning of prizes, the elevation of the district superintendent or the teacher, any form of advertising, *an exploitation of the child in any way whatever*, a contest for the sake of appearance, has no place either within or without the school. If the district superintendent can keep all these things in the background, although some of them may be incidental, agricultural contests can be made really helpful and a sound basis for school work.



A prize-winning beet, and the grower

In the conduct of this work, county farm superintendents, Young Men's Christian Association secretaries, grange leaders, and others can be of much assistance in cooperation; but in order to be entirely successful, the work must be planned and organized primarily by the district superintendent and teachers, and introduced through the school organization.

Every one came to the exhibit

Pupils should not be urged into contests. They should be given such encouragement as is necessary, but it should be entirely optional with them and their parents whether they enter or not. No matter how anxious pupils may be to enter the contests, their entry should be conditioned on the consent of at least one of the parents. After enrolling as contestants, pupils should be made to feel that it will be almost dishonorable not to finish the work started. We need to teach children to consider their undertakings carefully and to complete them when started. The world has enough starters; it needs more finishers.

That part of the motto " Simple beginning, permanent direction " printed in last year's contest leaflet is very apt. The contests should not be undertaken on a larger scale than will permit of permanent direction. They cannot be started and left to themselves until the day of exhibit. For a beginning, I know of no better plan than to start with corn or potatoes, or both, and conduct the contests along the lines suggested for boys and girls under sixteen years of age in last year's leaflet. A detailed record of the growth of the crops should be kept by the pupils.

Little emphasis should be placed on prizes. If proper encouragement and direction are given, the pupil will feel that he has been rewarded by the pleasure that he has experienced in raising his crop. The competition must be wholesome, and not selfish.

It is well to hold an exhibit at the close of the contests and invite parents and others interested in school work to attend. These exhibits may be held in the schoolhouses by districts, by towns, or by supervisory districts. Grange halls, also, are very suitable as places for exhibits. It is well first to hold an exhibit in the schoolhouse for the school district, and later to hold a general exhibit for the town in some convenient place. At these exhibits some recognition by means of prizes should be given, but it is better to base the prizes on the quality of the exhibit rather than on superiority over some one else. A sweepstakes prize for the best general exhibit can be given advantageously. Again, care must be exercised to see that the exhibits are really helpful in creating a proper interest in agriculture and nature study; that they are not used as a means to exploit the child. It must be kept in mind that the contest, and every part of it, is a means, not an end.

For older pupils contests based on economic production are very satisfactory. They furnish an opportunity to teach some practical arithmetic, and they also teach the young farmer the importance of farm accounting; but for a beginning it is not wise to undertake too much, and it is recom-

Some of those who attended the exhibit mended that the contests be limited to corn, potatoes, vegetables, or some other one or two crops adapted to the locality, and that they be organized as simply as possible. Both boys and girls should be permitted to enter. In the contests conducted in the first supervisory district of Oneida county, the sweepstakes prize was won by a girl.

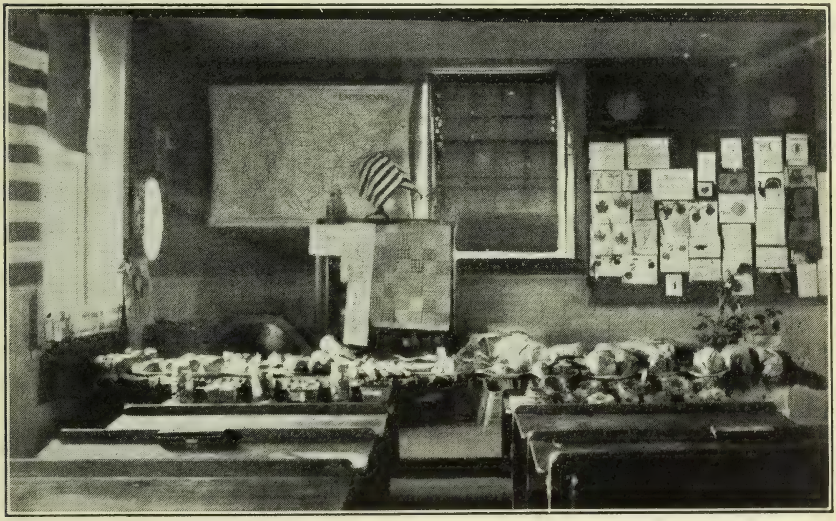
The district superintendent must not expect that the district school-teacher can teach agriculture as a science. She is not qualified to do so, and it is not necessary. If the matter is made a textbook study entirely it will fail. Immature pupils are not ready to study science as such, but when properly directed they become intensely interested in the things near at hand. The teacher should be a learner with the pupils, and she, as well as the pupils, will be surprised at the many beautiful things in her environment that she has never seen.

Successful contestants

The contests furnish much material for school work and can be used effectively in teaching the " three R's." For example, does it not furnish quite as good arithmetic for the pupil to compute the number of hills of potatoes in an acre, with the number of hills in a row and the number of rows in an acre given, as to compute the number of miles sailed by a vessel in twenty-four hours, with the number of miles sailed per hour given?

Is it not as good arithmetic — and likely to be more interesting and useful to the pupil, because it comes within his environment — to compute the percentage of increase of crop over seed, as to compute the cost of insurance on a cargo of cotton, when he has never seen raw cotton? Is it not as good geography to trace the corn or potato crop from the field over the highways of commerce to the places of distribution and consumption, as to take an imaginary trip through the Sahara desert? Will not the boy or girl write a better composition in describing his work in the contest or some phase of it, since it comes within his experience, than he will in describing the city of San Francisco when he has never seen a city?

Nature study and agriculture are not separate subjects in the sense that arithmetic and geography are. They do not readily lend themselves to written examination. They may or they may not have separate periods assigned on the program, as do these other subjects. In their study the textbook should be secondary, not primary. It should be a book of reference to confirm lessons learned outside. In contest work, as in all nature study and agriculture in the rural school, a means is furnished for using the child's environment for his advancement and for developing within him a love of the beautiful.



A rural school exhibit

If contest work is conducted with these principles in mind, parents will become interested, teachers will have new material to use in their work, pupils will take a new and added interest in all phases of school work, and all will come into a new relation with, and a new understanding of, the beauties of rural life.

HEALTH ON THE FARM

C.-E. A. Winslow

(Director Division of Publicity and Education, New York State Department of Health)

We suffer from many diseases due to many different causes; but there is one class which every one should know about because the diseases in this class may be so easily avoided. These are such diseases as typhoid fever, diphtheria, scarlet fever, and the like, which are known as communicable diseases. They are all due to microbes — small, living germs — and by keeping the microbes from spreading we can prevent these ailments.

Where disease germs come from.— The germs of typhoid fever and the other communicable diseases always come from human beings (or in a few cases, as tuberculosis, from the cow or other higher animals as well). The persons from whom the germs come may not be actually sick themselves, for some persons (called carriers) may seem perfectly well while they are distributing virulent germs of disease. The disease germs do not come primarily through water, earth, or air, but from human beings, and the problem of sanitation is to prevent their spreading from one person to another.

The care of human wastes.— Since human wastes, or excreta, are always likely to contain disease germs, it is very important that they should be disposed of so that the germs may not be spread. One of the first things necessary for the health of persons on a farm is proper disposal of the wastes.

The old-fashioned outdoor closet is often a fertile source of typhoid and other diseases. If the excreta are allowed to collect in an open vault, germs may pass down through cracks in the soil and pollute the well. If the excreta pile and flow over at the back of the closet, they will wash over the surface of the ground at times of rain, and may pollute the well; or germs may get on the shoes or the clothing, and then on the fingers and into the mouth. If the excreta are not protected from flies, these insects may carry the germs to food in the kitchen.

The ideal dry closet for the farm is shown in Fig. 1. The excreta are collected in a tight metal pail or barrel, and are taken away and buried when necessary at some point away from the house and the well. The pail is in a special compartment opening at the back, tightly closed so as to keep out flies; and the whole closet is screened in order to keep out flies, and has a tightly fitted door.

There are other ways in which the closet may be made safe; for instance, by building a cement vault for the excreta, instead of using a pail. The two essentials are that the receptacle for the excreta be tight, and that the whole toilet be well built and screened so as to keep out flies.

How are the excreta cared for at your school and on the farms in your community?

How disease germs spread.— Disease germs do not live long outside the body, and the danger from them lies in their rather direct transfer from one person to another. There are three principal ways in which they are spread: by insects, by foods, and by direct contact. If we control these three agencies, we can prevent the spread of disease.

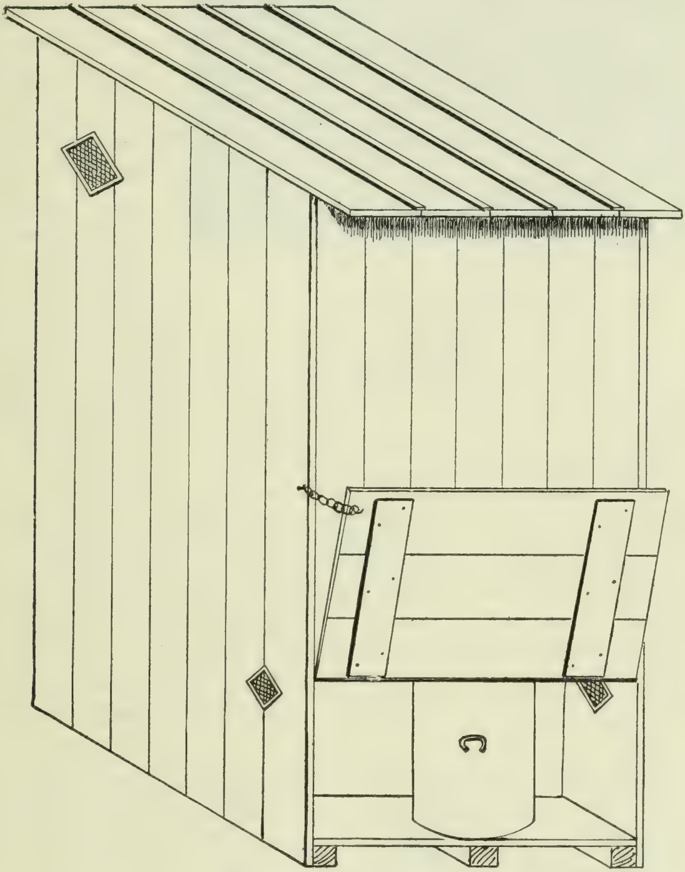


FIG. 1.— *Ideal dry closet*

Insects and disease.— The principal insects that spread disease in New York State are the mosquito and the fly. A certain kind of mosquito, called Anopheles, is the cause, and the only cause, of malaria; for the Anopheles mosquito bites a person infected with malaria, sucks in the germs of the disease, and then bites another person, inoculating him with the germs — and this is the only way in which malaria is communicated.

The fly is only one of many causes of typhoid fever; but in the country it is often an important cause, since it may easily alight first on infected excreta and then on food, carrying germs on its feet from the former to the latter.

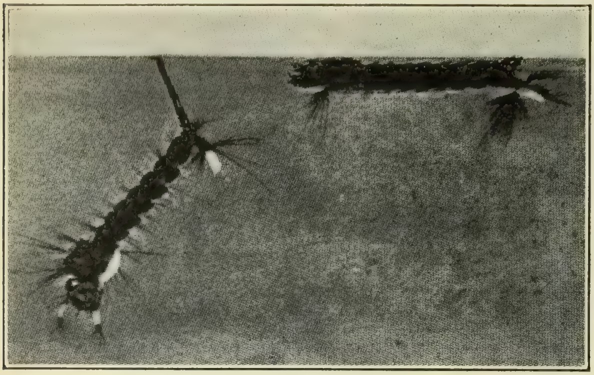


FIG. 2.— *Mosquito larvæ*
Culex *Anopheles*

How to control mosquitoes.— Mosquitoes lay their eggs and breed in stagnant water. The way to control them is to drain or fill in small pools, clear the channels of sluggish, weedy streams, and empty barrels, pails, and other vessels of water in which the insects may breed. If a pool cannot be done away with, mosquito-breeding may be prevented by pouring a little kerosene or crude oil on the water every two weeks. The oil spreads out in a thin layer on the surface and kills the larval mosquitoes in the water.

If there are mosquitoes about your house, try to find out where they are breeding. The larvæ are little, blackish wigglers, about three eighths of an inch long, which are generally collected at the surface. The larva of the common mosquito (Culex) rests at an angle with the surface, and the larva of the malaria mosquito (Anopheles) rests flat against it (see Fig. 2). If you dip out some water from a pool or a stream in a white enamel cup and find little wigglers like this, you may know that mosquitoes are breeding there and the water should be drained away or oiled.

How to control flies.—The common house fly, which may carry the germ of typhoid fever, breeds (as a little white maggot) in all sorts of decaying organic matter; it prefers horse manure, but it will breed also in human excreta, or cow manure, or garbage, or spoiled food, or refuse such as papers and the like. The best way to control the fly is to do away with its breeding places; to keep manure in tight, dark, covered receptacles or remove it once a week; and to keep the yard, so far as possible, free from heaps of garbage and refuse.

It is an excellent thing to trap as many flies as possible, and this can be done with a trap such as is shown in Fig. 3. Such a trap may be made from a grocery box by substituting wire netting for the top and two sides, cutting a round hole in the bottom, and inserting a wire cone with an eight-inch opening at the bottom and a half-inch opening at the top. A suitable bait — a fish's head, for example — may be placed under the box, and the flies that seek it will fly from it upward toward the light and through the small top opening into the box. Dead flies may be shaken out through a small opening ordinarily closed by a sliding door.

It is almost impossible to get rid of flies entirely, although their numbers may be greatly reduced by the methods indicated. Doors and windows should be screened, especially in the kitchen and dining-room and any room in which there is a sick person; and care should be taken to see that the screens fit accurately, and that they are always in place, and that screen doors are not left ajar nor held open. If one cannot afford wire screens, flies can be kept out by cotton mosquito netting tacked over the windows.

The farmyard well.— The principal foods that may spread disease are water and milk, and one of the most important essentials for good health on the farm is a safe water supply. A good well is usually the best place to get water on the farm. Water from a running stream looks bright and pure as it ripples over the rocks, but it is always dangerous because one never knows what pollution may have entered into it above. Lake or pond water, too, is likely to be polluted by sewers or by pollution washed in from the banks, unless the lake is a large one and the shore free from sources of pollution.

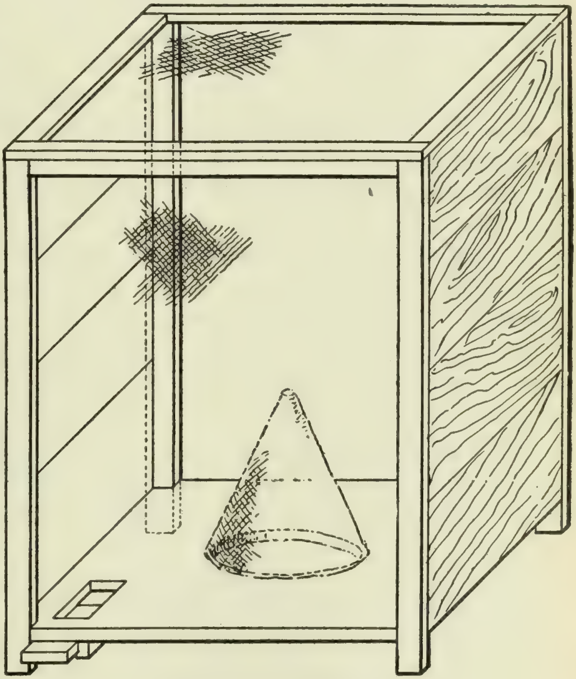


FIG. 3.— *A simple flytrap*

The reason why well water is usually good is that when water has been filtered through good, sandy soil any disease germs present will have been strained out by the sand. A filter made of the right kind of sand, a few feet in depth, is one of the best ways of purifying a city water supply, and the same purification takes place in many wells. If, however, the soil around a well is clayey or rocky instead of sandy, the water may not be filtered at all, but may trickle through cracks and bring all its dangerous germs along with it. It is important, then, that the well should be not less than a hundred feet from privy, or cesspool, or manure pile, or barnyard, and if possible it should always be on a higher level than any of these sources of pollution. The underground water usually (though not always) flows through the soil toward the nearest stream or pond, and the well should never be between a privy vault and a stream or pond.

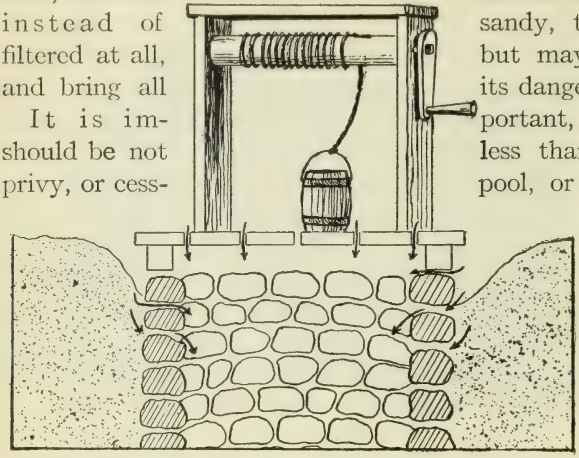


FIG. 4.—*An unsanitary well*

Another very important point concerning the farmyard well is that it should be protected from direct surface wash. Many farm wells are on low ground, with loose curbing and loose boards over the top so that all the wash from the barnyard runs into them when it rains (see Fig. 4). Such wells are not really wells at all, but very dirty little ponds. There are probably ten farm wells polluted in this way for every one that is polluted through cracks below the surface.

In Fig. 5 is shown how the farm well should be protected against such dangers by building the upper part of tight brick and mortar, putting a raised curb of concrete around the top and extending out into the ground all around, and covering the top with tightly fitting planks.

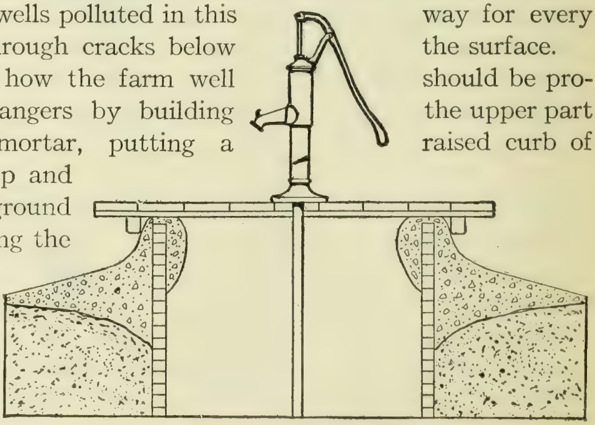


FIG. 5.—*A sanitary well*

Clean milk and safe milk.— Milk is another food that very commonly carries disease. It may be polluted with germs of tuberculosis from a tuberculous cow, or with germs of typhoid or diphtheria or scarlet fever or sore throat from human carriers; or the ordinary filth bacteria that get in from dirty pails, dirty barns, dirty hands, may grow in milk so as to form poisonous products and make it unfit for food.

The ordinary filth germs can, for the most part, be kept out by keeping cows and stable clean, using small-topped pails that have been thoroughly washed and sterilized, and straining the milk in a special milk house, screened to keep out flies. If the milk is quickly cooled to 50° F. or a lower temperature, the few germs that do get in will increase very slowly and the milk will keep sweet and good.

You can never be sure, however, that milk does not contain tubercle germs unless the cows are all examined by a veterinarian once a year and suspicious cows taken out of the dairy herd. You can never be sure, even with all possible care, that the man who milks the cow is not infected with some disease; if he is, one cough over the pail, one drop of milk from his hands, may pollute the whole milking.

The only really safe thing to do is to heat or pasteurize the milk before using it. There is no more reason why we should drink raw milk than eat raw meat. If a bottle of milk is pasteurized, placed in a vessel of water, and kept at 145° F. for thirty minutes, all disease germs and most of the other germs will be destroyed without in any way injuring the milk. About the same result can be obtained by bringing to a boil the water in which the milk bottle stands, then letting the whole vessel stand in a warm place at the back of the stove for thirty minutes. At the end of twenty minutes the milk must be promptly cooled. All milk for young children should be treated in this way. There are many sad cases of children contracting tuberculosis from their own fathers' cows on the farm.

Cleanliness in the kitchen.— Finally, there is a third way of spreading disease — by contact, more or less direct — which is the hardest of all to deal with. The germs in the excretions of sick persons or carriers get on the fingers, and, by food or in some other way, into the mouths of other persons. Glasses, spoons, and the like, are used in common. Germs are thrown out from the mouth in a fine spray in coughing, sneezing, or loud speaking. In these and a hundred other ways, they pass from one person to another.

The first safeguard against the spread of disease is the care that a sick person ought to take not to pollute things about him with his dangerous germs. When a person has any sickness at all, even only a cold in the head, he or she should not come too near other persons, should be careful not to sneeze or cough except into a handkerchief, should not help in any way in the preparation of food, and above all should not go near a baby. Measles and other serious diseases begin as a cold in the head begins, so that you never can tell how much trouble a little carelessness may cause.

On the other hand, well persons should protect themselves from danger by keeping guard over their mouths and watching what goes into them. Most disease germs enter the body by way of the mouth, and if we would keep out fingers and pencils, and everything that can be kept out, and see that such things as glasses and spoons and any articles that must touch the lips are always clean, the communicable diseases would largely disappear.

Editors' Note.— Sound health is fundamental to all activity. Questions of hygiene and sanitation have both an individual and a social aspect. A teacher often has opportunity to impress on the children fundamental rules of personal hygiene that will lead to the formation of habits of cleanliness and to proper care of the body. The older boys and girls will be able to understand the social questions involved in proper sanitation, and through them the teacher may find opportunity to improve the condition of the school building and outhouses. There is much uncertainty as yet regarding the best type of sanitary toilet for the country, but ashes and slaked lime are not difficult to obtain, and the children may be taught to use such simple means of making the outhouses less unsafe and objectionable. There is no excuse for neglecting to take proper care of such outbuildings at frequent intervals.

We are particularly impressed with the conditions existing in rural schools during the early fall months with reference to flies. Understanding the danger that may come from diseases transmitted by flies, prompt measures should be taken to remove their breeding places and to prevent their entrance into the buildings. It would not be a difficult matter to thoroughly screen a rural schoolhouse and the outhouses. Except the framework of the screen door, which the local carpenter would undoubtedly be glad to make, the older children would find it very good exercise to put on the wire or cloth netting. This is a definite piece of work with an end in view that affects the health of the entire school body. We should be glad to hear from rural schools that succeed in securing protection against flies.

Many ideals for cleanliness in the home can be worked out in any rural school. The teacher who aims to have the cleanest and most orderly building in the State is making effort for fundamental educational progress. Consultation with district superintendents of schools on this question will doubtless result in the necessary materials for keeping the schoolhouse in sanitary condition. If the children do the work they will be taking part in effort that will eventually become habit, and the things learned at school will benefit the homes. Cleanliness and refinement are also "catching." Both lead to better health.

THE NOON LUNCHEON

CLARA BROWNING

Although the fact is well established that a sound body is a basis for a sound mind, we have been slow to recognize in a practical way some of the most important factors contributing to sound bodies. Now, however, in all quarters, an encouraging emphasis is being placed on the value of fresh air, exercise, sleep, cleanliness, and good food. Of these I wish to emphasize here the matter of food, particularly with reference to the diet of school children.

In the food problem, as in all universal problems, every individual is directly concerned; and who should be more so than the group of workers who, as teachers of the rising generation, are by common consent and opportunity leaders in their communities? As leaders, whose first interest is the welfare of those in your charge, you find that the general problem belongs to you as well as to those who are specializing in the subject of food.

The importance of good food for the growing child has been strikingly shown by the fact that those schools which provide school luncheons show a decreased number of cases of malnutrition and an increased improvement in health and scholarship. It is certainly true that children cannot do their best work when they are poorly fed. Cases of malnutrition are not limited to the cities, as may be seen by a glance over many of our rural schoolrooms; and if teachers will give the matter some consideration, they will find opportunity to help meet a very fundamental need of many farm boys and girls. A good beginning in this work might be made in an investigation of the box luncheon. If the box luncheon is not well planned we may infer that the other meals are not right. How often the box contains something like this: thick, unappetizing sandwiches, a piece of meat, doughnuts, pickles, and pie. Instead of fruits and vegetables, so valuable for their minerals and because they are natural laxatives, there is an abundance of rich food difficult of digestion by those not engaged in vigorous physical exercise. So unappetizing is the food likely to be, and so unappetizingly packed, that probably the child will not eat the one thing good for him — that is, the bread.

Here is a problem and a serious one. Our concern is with its solution. To this end I see but one means — education.

Let us consider a few of the channels through which this education may come. Obviously few of us can be directly engaged in original searching after dietary truths, but each can help in passing these truths on from original investigators to the masses of the people. Knowledge concerning fresh air, the value of exercise, and the like, is general. He who is ignorant of these things is classed as uneducated. But, oddly enough, when it comes to knowledge about food we find, even among otherwise well-educated people, a strange ignorance. In the realm of food, habit largely rules. For instance, fruit is common in many American dietaries; but if it were inconvenient to provide fruit, how many would continue to do so because they realize its food value? Simple dietary facts should be a part of the general knowledge of every educated person. We who are teachers should have an intelligent knowledge of these subjects of general interest, for the first step toward the dissemination of such facts is to learn them. Excellent bulletins in which food and dietetics are discussed may be obtained from the United States Department of Agriculture and from the domestic science departments in state and other institutions.

The much-needed instruction in foods must be given by the general teacher, who finds it difficult to add to the already crowded school day. Correlation must therefore be the teacher's chief assistant. To illustrate briefly, let us suppose that we want to teach something about eggs, which can be examined in the nature-study class. What child is not interested in the egg — in its storage of food, in the wonderful anchors that hold the yolk in place, in the marvelously fine skins that line the shell, and in the wonderful porous shell itself? Who is not impressed with the thought that, since the little chick is completely formed in the egg, the egg must contain all foods necessary to form bone, blood, muscle, and every part of the little chick? No wonder that we find this food material nourishing. English and composition work relating to the chick may follow this study. Something about the use of eggs in different countries will add interest to the geography lesson. Problems in arithmetic may include some instructive ones about eggs. For instance:

Eggs average fifty cents a dozen from December to March, and twenty-two cents a dozen in May and June. Water glass costs thirty cents a quart. One quart of water glass will be enough to preserve thirteen dozen eggs. Will it pay me to store thirteen dozen eggs in water glass in June for use while eggs are fifty cents a dozen? (Allow for loss by spoilage of one dozen; also allow for two hours work in storing the eggs at twenty cents an hour.) If it will pay, how much will be saved? By means of such lessons, which in no sense interfere with arithmetic as such, accurate and practical information can be given.

Then, sometime in the day there might be time to put an egg into a test tube and set the test tube in a pan of hot water. No thermometer is necessary in order to show that the egg coagulates below the boiling point. This principle underlies all protein cookery. Any child can see the reason why eggs are toughened by over-cooking. If occasion permitted at the noon hour some day, the teacher might be willing to demonstrate something like the poaching of an egg or the preparation of soft-cooked eggs.

In fact, the noon hour offers many opportunities. During the winter months it is desirable to have something hot for luncheon. Why not arrange to have those who eat at school club together to furnish one hot dish a day? Simple, inexpensive, but nutritious dishes, such as cocoa, creamed soups, and creamed vegetables, could very easily be prepared. In every school there is a group of girls who would be delighted to help in such an undertaking. No small return to them would be the practical information they would receive, and the training in cooperation and executive ability. If teachers find it possible to arrange for some addition to the otherwise cold luncheon, the following recipes may be useful:

The noon luncheon needs intelligent supervision

(A standard measuring cup is one fourth quart. All measurements are taken *level*.)

COCOA (INDIVIDUAL AMOUNT)

2 teaspoons cocoa (or one of cocoa and one of grated chocolate)
1 teaspoon sugar
1 cup milk (half milk and half water may be used)
A little salt

Mix cocoa, sugar, and salt. Add a little water. Cook over direct heat in top of double boiler until thick (about one or two minutes), stirring constantly. Add milk. Put top of boiler over lower part; set on stove to get hot.

Cocoa is first well cooked because of its starch. If thick cocoa is desired a little cornstarch may be added. Milk is not boiled because boiling deteriorates the flavor. The mixture is heated in a double boiler in order to allow long cooking, which insures delicious blending of ingredients. The cocoa improves by standing. Beating the cocoa with a dover egg-beater makes a froth on the top which prevents the formation of scum.

Cocoa prepared in this way will be smooth and well cooked, there will be no specks of unblended cocoa, and the flavor should be delicious.

A lesson on the manufacture of cocoa would be very interesting. Several of the large cocoa houses send out very attractive educational exhibits describing the fruit and the process of manufacture.

CREAMED SOUPS AND VEGETABLES

The basis of these dishes is white sauce, which is merely milk or some other liquid thickened with flour. To this as much butter and seasoning are added as is desired. The proportions of milk and flour depend on the use of the sauce.

The general formula for white sauce is as follows:

Thin, for soups, ¼ to 1 teaspoon flour to 1 cup liquid
Medium, for creamed vegetables, 2 teaspoons flour to 1 cup liquid
Thick, for croquettes and puddings, 4 teaspoons flour to 1 cup liquid

The liquid may be milk, vegetable stock, meat stock, fruit juices, or similar liquids, depending on the desired result.

In making creamed soups a smaller amount of flour is used with such vegetables as potatoes and peas, which in themselves add thickness to the soup. Vegetables that contain no starch, such as celery and tomatoes, need a thicker white sauce. Let us take the recipe for one serving of potato soup as typical of creamed soups.

Cream-of-potato soup

¼ teaspoon flour
1 teaspoon butter
1 cup milk
1 small potato
Butter, salt, and parsley

Melt butter, but do not let it get very hot. Add flour. Stir together. Pour the mixture slowly into well-worked potato, stirring constantly. If potatoes are added to the white sauce, the soup will be lumpy.

Flour and butter are first mixed as an easy way of separating the starch grains, and so preventing the formation of lumps when milk is added. If the soup is allowed to cook slowly in the top of a double boiler for some time before serving, the flavor will be improved. Parsley should be added immediately before serving, since cooking destroys its color.

EQUIPMENT

Some suggestions as to necessary equipment for schoolroom luncheons may be helpful:

Utensils needed by each pupil

- 1 napkin
- 1 plate
- 1 bowl
- 1 cup and saucer
- 1 glass
- 1 teaspoon
- 1 knife
- 1 fork
- 1 tablespoon

General equipment

1 teakettle,	$0.75	1 bread knife,	$0.25
1 large double boiler,	.75	1 strainer,	.10
1 large stewpan,	.40	1 tin measuring cup,	.05
2 small stewpans,	.15 each	1 glass measuring cup,	.10
1 frying pan,	.25	1 potato masher,	.10
1 egg-beater,	.10	2 dish pans,	.50 each
4 tablespoons,	.10 each	1 large cooking spoon	
2 teaspoons,	.05 each	Dish towels	
1 palette knife,	.40	Dish cloths	
2 paring knives,	.10		

The above list, I believe, would provide for the preparation of many dishes. The cost of equipment might be greatly reduced by contributions from the homes.

CONCLUSION

After all, cooperation with the home is essential to the greatest success in educational endeavor. This is one of the great advantages of lessons on food, because through it cooperation is so easily obtained. Many mothers' clubs and women's clubs would eagerly grasp the opportunity to cooperate in the matter of better school luncheons, and better food standards in general. In many places women have been so interested in getting this practical knowledge for their daughters, that they studied the subject and delivered a course, one lesson of which was taught to a class of girls by each woman in her own kitchen on Saturday morning. In this way the work was not difficult for any one person. Some such arrangement might be worked out in the schoolroom at noon, so that now and then the teacher could be entirely relieved. There are as many ways of accomplishing the end as there are communities. Each teacher can and must devise her own plan of procedure. The first essential is to feel the need of this kind of teaching.

It is well for the teacher to have in mind each year a few definite needs, which should be emphasized. Following are a few dietary principles which will make a good beginning:

1. An abundance of fruits and vegetables should enter into the diet.

2. Children should not have much meat.

3. They should have plenty of milk and eggs.

4. Rich foods should be avoided.

5. A sensitive palate may be cultivated by avoiding too many highly flavored foods.

6. Water should be taken on rising in the morning, before going to bed at night, and many times during the day. The body needs internal bathing.

7. The children need to cultivate regular habits of eating.

8. Regular habits of evacuation of the bowels should be developed.

9. Whimsical choice of food should be discouraged. Only persons who stay in one place all their lives can afford to be provincial in their eating habits.

10. Beauty produced by cleanliness and order is as important a factor in a good meal as is the meal itself. Lessons in the beautiful do not belong to the drawing class alone. The beautiful is around us, and should be obtained and appreciated in every connection.

These few essentials to health cannot be taught without accomplishing many things. Food standards will be raised; but, more important still, children will see new interest in the common, everyday experiences, which is important in education. No longer do we believe that education has to do with artificial knowledge learned from books in the schoolroom. Education has to do with life — life in the schoolroom, but even more life outside the schoolroom. If, through some means as suggested here, a child becomes alive and sensitive to the interest hidden in the world about him; if he learns in school about things at home; if he sees parents and teachers cooperating in a common cause; if he learns to appreciate the importance and dignity of mere humdrum tasks such as cooking; and if he learns to take intelligent care of his health — then he has entered the life of freedom and he will thank the teacher for showing him the way.

Editors' Note.— To supplement the foregoing article we publish the following suggestions for box luncheons, taken from The Cornell Reading-Course for the Farm Home, July 1, 1913:

Foodstuffs that the luncheon should always contain

A substantial background of plain, nutritious, and mild-flavored foods, such as

Sandwiches
Bread and butter
Bread and egg
Bread and meat

A succulent food, such as

Apples
Apple sauce
Peaches
Oranges
Lettuce
Tomatoes
Fruit jellies

A dessert or dainty, such as

A piece of pie
A piece of cake
A few pieces of candy
Nuts and raisins
Cookies
A pudding or custard

Possibilities of variety in selecting foods for the box luncheon

The sandwich

Kinds of bread for sandwiches

White bread, brown bread, raisin bread, graham bread

Materials for filling sandwiches

Meats: sliced thin, chopped or ground, and softened with cream or salad dressing

Fish: sardines, salmon, oysters, shrimp. Used as purchased or made into paste with dressing

Eggs: fried, chopped and mixed with salad dressing, sliced, and seasoned

Cheese: both soft and firm cheeses are good, either sliced or made into paste. Mixtures of soft cheese, such as cheese and pimento, cheese and nut, cheese and olive

Vegetables: lettuce, water cress, cucumber, beans, pepper relish, tomato

Fruit: jellies, marmalades, preserves, fig filling, raisin filling, preserved ginger

Miscellaneous fillings: combinations of above, peanut butter, baked beans

Meats

All meats may be used

Potatoes

Since as a rule potatoes do not taste good when cold, only two ways of using them are recommended — potato chips, potato salad

Fruit

Oranges, apples, pears, peaches, plums, berries, grapefruit, figs, dates, bananas

Eggs

Boiled, deviled

Vegetables

Tomatoes, baked beans, celery, radishes, onions

Desserts

Cookies, candy, cakes, pies, nuts, doughnuts

Relishes

Horse-radish, mustard pickles, pickled beets, chowder

If suitable containers are used, the list may be extended to include:

Puddings, preserves, sauces and canned fruits, milk, fruit juices

If there are facilities for heating foods, the box luncheon may be extended to include such foods as

Cream soups, meat soups, meat stews, cocoa

From this list of foods, together with the many combinations that it suggests, selections may be made to satisfy all needs. In making a choice, however, careful thought should be given to the age, digestive powers, growth, needs, and activities of the persons for whom the food is selected. While the growing child with immature digestive apparatus has much the same fundamental food needs as has the vigorous outdoor worker, he will not be able to assimilate the same strength or the same amount of food as will such a worker. More attention should be paid to attractiveness and flavor in the luncheon of the child than in the luncheon of the older, and possibly more vigorous, person.

Differences in the food needs of various individuals are too often overlooked, especially in the case of children's luncheons. As a result, luncheons frequently consist of foods that are difficult for children to digest, such as pies, doughnuts, meat, and pickles; at the same time such luncheons lack simple, nutritious, and easily digestible foods, such as eggs, bread and butter, fruit, simple cakes, cookies, and milk.

THE NATIONAL AUDUBON ASSOCIATION

T. GILBERT PEARSON

Editors' Note.—The study of birds is one of the most interesting and valuable in the field of natural history. It is often desirable to organize the boys and girls for bird study, and, inasmuch as the National Association of Audubon Societies is the recognized center of ornithological activity, we have asked Mr. T. Gilbert Pearson, Secretary of the Asssociation, to prepare the following article, outlining the work done by the Audubon Societies, and particularly dealing with the Junior Audubon classes into which schools may be organized.

The headquarters of the National Association of Audubon Societies are located at 1974 Broadway, New York City.

The National Association of Audubon Societies for the protection of wild birds and animals is an endowed institution, incorporated under the Laws of New York.

The objects of the association are to arouse in a greater degree the public conscience on the important subject of preserving the wild birds and game animals of the country, and to secure protection at all times for the valuable non-game bird life.

The activities of the association are directed primarily to the following fields:

1. It cooperates with the state Audubon societies, state agricultural colleges, natural-history organizations, and local state and federal authorities, in promoting the study of birds, the dissemination of knowledge concerning bird life, and the protection and increase of useful species.

2. It conducts legislative campaigns in many States for the enactment of adequate and necessary laws to protect useful birds and animals.

3. It conducts ornithological surveys and recommends the establishment of bird sanctuaries to state and federal authorities.

4. It employs a force of wardens to protect the more important colonies of ducks, geese, gulls, terns, pelicans, and other water birds throughout the United States.

5. It maintains a corps of field agents and lecturers who are constantly bringing to public attention the value of the wild bird and animal life.

6. It is actively interested in regulating the plumage trade and the suppression of traffic in the feathers of native birds.

7. It has been largely responsible in preventing the trapping of thousands of mocking birds, cardinals, and other native song birds, for sale in large cities or for shipment abroad, and it is endeavoring in every way possible to control the cage-bird traffic.

8. Through the magazine *Bird-Lore* and by correspondence, the home office serves as a clearing house for all matters pertaining to methods of attracting and preserving birds.

9. It publishes and distributes thousands of illustrations of North

American birds, accompanied by leaflets containing in popular form a résumé of the latest known facts regarding the feeding habits and general activities of the birds described.

10. It is organizing many thousands of school children and other young persons into classes for bird study.

Black and white reduction of large color plate

JUNIOR AUDUBON CLASSES

Special contributions amounting to about $20,000 have been subscribed to the association, to be used in aiding teachers and pupils during the school year 1914–1915.

Any teacher or other person who will interest not less than ten children in contributing a fee of ten cents each to become Junior Members, and will send the money to the office of the National Association, will receive for each child ten colored pictures of wild birds. With each one of these ten pictures there is an outline drawing intended to be used by the child for filling in the proper colors with crayons. Each picture is also accompanied by a four-page leaflet discussing the habits and general activities of the bird treated. Every child receives also an Audubon button. The cost of publishing and mailing this material is a little more than twice as much as the child's fee, the excess being defrayed from the contribution of $20,000 mentioned above. During the school year ending June 15, 1914, more than one hundred thousand children were enrolled in Junior Audubon classes.

The teacher who forms such a class receives, without cost to herself, one full year's subscription to the beautiful illustrated magazine *Bird-Lore*. This is the leading publication in the world on bird study. To the teacher there is sent, also, other free literature containing many hints on methods of putting up bird boxes and of feeding birds in winter, and descriptions of methods of attracting birds.

The accompanying illustration will give some idea of the character of these pictures, which are in natural colors, printed on cards of sufficient size to make attractive schoolroom decorations.

The ten subjects to be supplied to children during the coming year are as follows: bluebird, Baltimore oriole, song sparrow, house wren, robin, downy woodpecker, chickadee, green heron, brown thrasher, and whippoorwill.

Endorsing this work, Dr. P. P. Claxton, United States Commissioner of Education, says: "I consider the work of the Junior Audubon classes very important for both educational and economic results, and I congratulate you upon the opportunity of extending it. The bird clause in the Mosaic Law ends with the words 'That it may be well with thee, and that thou mayest prolong thy days.' The principle still holds. I hope that through your efforts the American people may soon be better informed in regard to our wild birds and their value."

For further information address

T. Gilbert Pearson, Secretary
National Association of Audubon Societies
1974 Broadway, New York City

A school group in St. Lawrence county

Off for the day

TEACHERS' LETTERS

The Editors

One very strong evidence of the interest in the teaching of nature study and agriculture in our rural districts is to be found in the excellent reports made to us directly by rural teachers. Hundreds of such reports are in our files, and have been a source of great encouragement to many who are concerned with a better country-life education for children. It has seemed to us desirable to publish a few of these letters. We have very many communications as inspiring as those from which we have taken the extracts in the following pages, and we regret that there is not space for all.

R. F. D. No. 10
Dunkirk, New York

In reply to your request for a plan of my nature work I hardly believe I have done much that is worth repeating, but if I have I shall be glad to have it help others.

Unlike many schools the building is in fair condition; there is a library of seven hundred books, a basement with toilets, an organ, eight wall maps, etc. The district takes pride in keeping it in fair shape, and yet the children were indifferent.

After the library was added to the building, a large bookcase with glass doors was left empty (except the dust) and the museum had been neglected so long that not a pupil could remember of adding any new specimens or even dusting it.

I decided to fill the bookcase and renew an interest in the museum. We are about thirty rods from Lake Erie and eat our lunches on the beach in suitable weather. When I began talking about the shells and stones, they walked away, but I persuaded the youngest ones to carry back to school several kinds. The next rainy noon I broke apart all the stones, thus exciting their curiosity but no questions were answered. For their next nature lesson I told them all I could of the formation of rock, the different ages, strata, fossils, etc. Then we examined the broken stones and they began to recognize iron, quartz, flint, mica, etc. The next day at the lake a few were interested and examined the stones for a purpose. Soon all were searching for new kinds and asking questions. For weeks they spent their noon hours on the beach. I cleared out the museum, and threw away everything that they could duplicate. As their largest specimens were put on one shelf of the museum, I labeled them. Soon each child had a collection of his own labeled like that in the museum. We sent some to a near-by high school to be classified. Their marks in nature study for September were based on their collections (I had no idea of this when I began). The first and second grades did not collect. The children began to bring specimens from other places, and the neighbors who heard of it sent in. Soon we had another shelf of the museum filled. These were labeled including the place from which they came and the name of the giver.

The last shelf just filled itself; nests, cocoons, honeycomb, wasps' nests, fungus, etc., were all welcomed. I make the most of every donation and put it in the museum. When it has been there a while, if the child sees that others are better, he asks to have his removed. (I asked them to tell me when it had been there long enough.)

By the end of September we had learned about all we could. I had used less than an hour of school time, geography had a new interest, and, best of all, they had begun to use their eyes. In the spring we will begin again, for the beach will have many new specimens.

I noticed that many companies sent out educational exhibits. I give the children the addresses of all I can find and they write the letters asking how we can obtain the exhibits. These are for the bookcase. As each exhibit comes we look it over and read the circulars and pamphlets carefully. Most of the exhibits are more helpful in geography, but some are just as interesting in our nature work. The writing of letters is a part of the English. They acknowledge receipt of all exhibits, also.

One day I discovered that the children knew very few of the weeds and wild flowers that grew along the roadside. Once or twice a week I picked flowers of as many kinds as I could on my way to school. That unsightly bunch of weeds attracted their attention. I held them up one at a time to be named (or passed the smaller ones around). They learned them quite rapidly. Every time I tried to put in a few new ones. In a week some of the children themselves began to bring new ones. Sometimes it took quite a while to find the names but we never gave them up. Later I asked the children to bring all *they* could find. As the frosts came we had to name the plants by leaves and seed pods. Our lists included bushes, trees, weeds, garden plants, and grasses, and clovers. Near the end we made lists of those we knew in our nature books, classifying them as to colors (as in *How to Know the Wild Flowers*).

During the cold weather we have made a special study of weeds in the syllabus, and learned how to destroy them. The work will be opened again in the spring with many new varieties.

For their last lesson in October I arranged over fifty kinds around the room, numbered them, and they named them (like a guessing contest). This gave them a nature mark for their monthly report. No one below the third grade took part although some had learned many.

For our work on fowls, the children cut pictures from old poultry papers (given by a parent) and pasted them in their Nature Books with descriptions of the fowls taken from the leaflet. The pictures were not very satisfactory for the study of combs but we did as well as we could (pictures were too small). They used one large picture to name the parts of a fowl as given in syllabus. Once a year they bring eggs, we boil them at school and study the parts as suggested in the leaflet for 1911. This is good because it comes outside of school hours. The diagram follows as a drawing lesson.

This year just as we finished our study of chickens there was a chicken show in a near-by village. I took the fifth, sixth, seventh, and eighth grades. It impressed their lessons on their minds. Not one regretted the walk home of a mile or more from the train after dark.

There is an up-to-date poultry farm in the district. We compared all our leaflet lessons with the farm (through the son). We will visit the farm and see an incubator hatch. The father gave us a very good talk at one of our " Parents' Afternoons."

My plan for studying cows is similar to that of chickens. They find the pictures of the different dairy breeds, write their descriptions in the Nature Books. I use hectographed outlines of the cow to name the parts. There is at the poultry farm a large, up-to-date, sanitary barn with silos, Babcock test, etc. We planned three Fridays last fall to visit it, and it rained every time, but we will enjoy it this spring.

In our bird study I supply each child with two colored bird pictures (Perry's one-cent size), those in the syllabus for the year that the individual child doesn't know. They look up the birds in the books and write compositions for English. These become a part of Nature Books. (This is done in winter when the smallest are not present and we have their time for it.) I have promised them to make bird houses this year. I have never tried it and it may fail. Many of my schemes do. I try to talk about the birds very often outside of school hours, tell what I saw, ask if any one saw the one I saw this morning, etc. If a bird gets near the window, I leave my lesson and study the bird. The children leave their seats but woe to the one who frightens the bird off. We put out our strings for nests in the spring, and throw out our crumbs in winter.

One day a little six-year-old boy came in with a Florida gallinule. How he caught it in his hands was a mystery. We looked it over carefully and let it go. We studied bird books for weeks before we found out what it was. A boy who had not paid much attention before brought us the picture and name.

My work with insects is a study of the leaflet in winter, and examining everything we can find in summer. Our trips to the lake furnish good opportunities. We had the mosquito and milkweed caterpillars in school. The caterpillars changed to chrysalids and to butterflies in school hours. We stopped everything else and watched.

We study the polliwogs in the creek near by instead of bringing them into school. We go every noon and look at them.

I have a kodak. I take pictures of each kind of tree to be recognized. I choose those in the yards or along the road to school if I can. The children make their own blueprints. These go in their Nature Books. They draw the leaf and seed pod on the page, and write a little description including the use of the wood.

I have tried school gardens, but I haven't made them successful. I give the children seeds and plants from mother's garden to encourage home gardens.

We make about three trips to the woods in a year. We go a little early, eat our lunch in the woods, and get back to school in time to rest before it is time to go home. This is quite necessary, for out of thirty-one only nine live within a mile of the school. The first trip was a failure but since they have found that eyes are to be used I can't begin to answer the questions. The most interesting points in our last trip were crows' nests, witch-hazel, and woodpeckers' holes.

I try to cover the work of the leaflet quite thoroughly in winter when there is more time because the smallest are absent. In summer I try to have them see or learn something new every day. It keeps me busy looking up material on what they find or see but it is worth while.

This winter there were two cars from California exhibiting in towns. We found a man to take us for a sleigh ride to see the cars. I was a little undecided; I was afraid it would not pay, but I shall never hesitate again. When a boy just past his seventh birthday can write nearly five hundred words on what he saw, it is not in vain. One car contained fruit, grain, etc., from California, but the other was a nature museum from all over the world. I mention this because I never knew before how little chance country children have to see things. The trips meant so much that they will never forget them. Every day some one says, " We saw that in the cars," or " That is like what we saw in the exhibit car."

I am afraid this is too long but I hardly knew which parts were unlike what all teachers do. If there are many parts that are not clear I will try again.

McKownville, New York

My interest in nature study began while I was attending training class at Schoharie, New York. Under the guidance of our good teacher, Anna E. Manktelow, we studied birds, plants, soils, weeds, and trees every available minute. We did not have much time but we enjoyed the rambles and lessons very much.

I have lived on a farm since I was nine years old, but I am very glad that from books, and the Cornell Rural School Leaflet for teachers especially, I have learned a few of the fundamental facts that underlie successful farming. I love the farm; I have done all kinds of farm labor, and I love that, too. If I can acquire money enough I'll have a farm some day. I am going to have a garden this summer. I am also going to plant a piece of potatoes on shares. I have written this first paragraph to try to show you why I like to milk, plough, harrow, plant, mow, rake, thrash, etc.

The first thing I did at Howe's Cave School was to send for leaflets. I began teaching February 1, 1912. The children enjoyed them very much. I had the primary department that term. Every morning we marched into Principal Springsted's room. We started a bird calendar on the board. We placed in a column the names of the birds recognized, and as soon as a pupil gave satisfactory evidence of having seen the bird, his initials were placed after the name of the bird. Sometimes a boy or girl would come to me before school and give a description, or at least tell me so I was sure, of the bird for which we were then looking. Of course, his or her initials came first on the calendar. They were very enthusiastic about it. One of the girls had a bird book, and some one was using it all the time.

We had the children count the number of trees on the school ground and distinguish the different kinds. We asked if there were any fruit trees. A number of the children had never recognized a thrifty young apple tree which was thriving before their very eyes. They know it now because they helped trim it. All of the children were interested in the trees. We used to go into a near-by grove and name all the trees we could.

All of the children saw the downy woodpecker and redwinged blackbird.

We also studied the toad. One of the boys brought a toad. I passed it around and had them observe certain things pointed out in the syllabus and leaflet. We also discussed the value of toads in a garden. We kept the toad for a day in a pail of moist earth. When we started some of the children were afraid of getting warts, but I explained to the children how people had been mistaken in this. I think nearly every one handled it before we set it free just to prove that it was harmless. When we let it go it hopped off as if nothing had happened.

We had a hen brought into school, and a very interesting observation lesson resulted.

Last year at District 10, Town of Wright, Schoharie county, we studied the hen, made a collection of feathers, studied the feathers. We also studied the cock. We had both brought into the schoolroom. Each child had a very successful home garden. I filled out their orders for seed early in the spring. One pupil raised two bushels of potatoes on a couple of little, unhandy corners of the main garden. He also had fine peas and cabbage. He pecked up the ground himself. In another home, three little girls each had a garden. One of them grew some of the largest cucumbers I ever saw. They all had China asters.

This year at McKownville I have fifty-three pupils in seven grades. I haven't had much time, but we take a few minutes each morning, about five minutes, to talk about birds, or trees, or plants.

Each child above the second grade keeps a bird calendar from which he makes reports. The little ones tell what they see. Last Friday we studied pitch pine. They discovered, by observing specimens which they held, that the white pine has five needles in a group, the pitch pine three; that the bark of white pine is smooth, the needles are dark green, and the yellow or pitch pine has yellow-green needles and rough bark. Then I showed them a top of a small white pine tree which one boy had brought in. I told them what a hard struggle the white pine has for existence, asked them about its uses, and cautioned them kindly not to harm little trees. Then they asked me of what value the pitch pine was and I told them it made rough lumber, which they knew, and that it is also shaved for excelsior. We also noticed that the branches of the white pine form a whorl. Pitch pine is very abundant here. The land in this district contains broad tracts of waste and narrow strips of well-cultivated gardens. The chief business is raising pigs, on garbage collected in the city, and garden truck from the narrow strips fertilized by pig manure. These products are disposed of at Albany's public market and by peddling.

I have sent to the Perry Picture Company for pictures of the birds to be studied this year. I have them mounted and they are displayed two or three days each week. I gave the children brown mounts and they have mounted the pictures of the bluebird which they received in the leaflet. They have taken them home for their rooms.

We are going to mount a collection of feathers.

Our grounds are covered with beautiful trees. There is a sunny knoll sloping toward the schoolhouse just northwest of the schoolhouse. It is covered with white pine, pitch pine, white birch. So although the land is sandy we are going to try to make a flower bed. All of the available tree space is filled. The entire ground is bordered with beautiful maples and elms, and there are eleven scattered over the center. We have one of the best sites in the county, says Superintendent Clark.

We are going to plant vines to hide the old, high, board fence which separates the boys' playground from the girls'.

We had a splendid Christmas entertainment and tree. The schoolhouse was packed with people.

The children have enjoyed their leaflets very much. Each has learned one of the little verses about the birds.

They are all going to have a garden of their own, they say. I sent in their order for seeds. How eager they were to get the packets! They sent for a great many flower seeds and a large number of vegetable seeds. Our Congressman also sent us a large envelope of flower and vegetable seeds.

We are going to have an exhibit of work done in drawing, handwork, and nature study on Arbor Day. Some of our best drawings are of pussy willows which the children brought to school. Our best handwork consists of birch-bark canoes, made by fourth and fifth grades. Our best nature-study work will be the bird calendars. We have other pretty things for the exhibit, but these are the best. Our superintendent is going to select the best things in the exhibit of each school for a general exhibit at the Altamont Fair and also at the State Teachers' Meeting in Albany next November.

We also studied corn this year. We each learned by actual observation to select the best ears. The corn crop was poor last year.

I sent for Colgate's samples of tooth paste. We had a contest. Each one above the fourth grade wrote an essay on " Care of Teeth." A girl in seventh won first prize, and a boy in fourth won second prize.

The little children have woven some pretty mats from rags. The fourth and fifth grades made the looms with a string and pasteboards from the backs of tablets.

One little girl suggested that we take up a collection and get some new towels. We have four new towels and towel racks as a result. The girls hemmed the towels.

This year the trustee bought a covered tank for water. We have a good well on the school grounds. Each child, or nearly so, has since bought an individual drinking cup.

At a special meeting held March 31, 1914, it was voted that we have an additional room and an extra teacher the coming year. We hope to be able to do more along the line of nature study next year than we have this. The children love to write to Mr. Tuttle.

I am sending you a picture of some young nature students. About one third of them were sick when I took this picture about March 20, 1914. Chicken pox kept them out. I will send you another as soon as they are all present again.

Cortland, New York

I began my work in District —— with a school of nineteen pupils. The children and I at once began our work in nature study and agriculture with an interest on their part which was very gratifying.

We started our collection of bark, seeds, leaves, deserted birds' nests, etc., for our school museum. Then feeling the need of a new supply of library books, I suggested that the children get a soap order to raise money, which they were happy to do, and in a remarkably short time had a twenty-dollar order giving us ten dollars which the State duplicates; therefore we had our twenty dollars worth of books, among which were many good works for our work in nature study as, *Our Native Trees*, *How to Know the Wild Flowers*, different books about birds and insects.

During the spring months we had our aquarium with frogs' eggs, tested the germination of different seeds, etc.

When our term began last fall we took a penny collection, which we often do in order that each child may have a certain interest in all that we do. Each child gives one penny or more and I have always doubled the amount. With the money we raised at that time we purchased tulip, hyacinth, and crocus bulbs, and different persons gave us a generous lot of lily of the valley, peony, and daffodil bulbs. We have taken another collection this spring and are going to purchase vines to cover the outbuildings. We also intend to set several different shrubs.

The people have seemed very much interested in our work and have always been ready to help us in every way possible. It seems to me there has never been anything that has brought the home and school so closely together as this work in natural history and agriculture.

The children, instead of becoming tired of the farm and of country life, wake up to the fact that there is a greater chance for development physically, mentally, and morally and a greater work to be done in the country than anywhere else.

We have won several premiums at the county fair and are going to try hard for many more this year. One girl won first prize on an article written on "Alfalfa Growing." She studied diligently all farm papers she could get on the subject and talked with different farmers in the district who have been successful in raising alfalfa.

We have our Bird Booklets which have been made at school, containing pictures of the different birds studied, descriptions of the same, and observations the children have made. Also a booklet for the trees. Even the dull pupils become interested in this work and do better work in other things.

Jewettville, New York

I've just found time to answer your letter. I have a school of thirty-six pupils and all grades. I also do my own janitor work, so you may know that my time is quite taken up.

In regard to the work in natural history and agriculture, let me say I think it is the most interesting subject in the curriculum. All country children like it because they have stored away some knowledge of it before they have come to school. It is second nature to them. Most of them are ready to relate their experiences and observations, thereby creating an interest from the beginning.

Most of my little people had gardens of their own last year, and the larger ones took an active part in helping their parents on the farm or in the garden. For this reason the children are trying to gain more knowledge of the subject.

We have planted some seeds in boxes, and have watched them through the different stages of development.

We have observed the crops near the school, and we have tried to reason why the crop was a success or why it was a failure.

We have tried several experiments, one, for an example, how the plant takes in food and where it is carried.

My boys are now making bird houses. Some of the boys have set hens and are patiently waiting for the results.

My girls have brought their stockings to school to darn. On the whole, we try to keep busy, as work is interest, and interest is life.

I've had the pupils write compositions on such subjects as "Making Maple Sugar," "A City Boy's Life Compared with a Country Boy's Life," and "The Life of an Earthworm." I correlate natural history with English and geography as much as I can.

When we are reading poetry or stories of any kind, we always stop and talk over the word pictures of the country about which the story is related.

In the beginning of "Evangeline" is such a beautiful picture of the forest. The child may have never appreciated the forest before, but after we have talked about this forest and have compared it with the forest near our homes, I fully believe the child will have some love for the forest, and the forest will mean something to him.

Throughout "Evangeline" are beautiful descriptions of scenery. Also, in the book "Little Lame Prince," when the child comes to the part in the story where the little Prince Dolor rode away on his traveling cloak for some distance without seeing a tree or a brook, and then when he did see one (it being the first that he'd ever seen) what he thought of it, and how wonderful he thought it was. You know I think the child, with a little help, will appreciate his surroundings.

Perhaps the child has never realized what a rich country he is living in. But when his attention is called to the beautiful flowers, trees, creeks, birds, and animals that he is living among, he at once will acknowledge that God is good.

The poem "Snow Bound" is just beautiful for a child to grasp appreciation. "A Watcher in the Woods" is fine to make pupils curious. In the book "Boys of Other Countries" are many helpful things for a young child to read, as it will cause the child to think of the sanitary conditions of the home, etc. Almost all settings of good stories are taken from the country, therefore I think reading stories is a stimulus to make the child love the country home.

I am a subscriber to two farm papers. I take these to school. The children read them. We talk about them.

The children often bring clippings from their father's papers that they think would be of value to us. There is one out of the ordinary that I must tell you about. A little girl of eleven brought this to read to the class: "I'd rather be a farmer than a millionaire. If any one wants to know, I'll tell you why. A farmer has what a rich man cannot buy."

I think the fathers and mothers appreciate the active part that their children take in this work. I often ask the children to obtain certain information for me from their parents. I believe the people are in favor of this, as most of the parents have had a very limited education. They feel it an honor to impart definite knowledge to some one who they think has had a better opportunity in life than they.

There are a great many things that I am ignorant about. I am willing to learn and I am learning with my pupils day by day. I sincerely hope that I shall be able to inculcate in the hearts of my pupils a love for the things of God, and that each day I can plant in their souls some deed of kindness, and by so doing will create types of manhood and womanhood that the nation may be proud of.

Canandaigua, New York

It gives me great pleasure to write you a short account of my nature-study work. I know just how some of the teachers feel and what obstacles they meet with. So many of the districts have a new trustee every year and that generally means a new teacher. If a teacher does not stay more than one year in a place, where they have never had nature study and agriculture before, she cannot hope to create much enthusiasm. She can just nicely get started.

I was in one district for five years, and feel that the pupils there know quite a little along this line. They were all farmers' children and had a chance to put into practice what one attempted to teach. I find you cannot keep the children interested unless they have something to do. Just reading facts to them will not do.

So I always kept mine busy taking notes, collecting pictures to fit the notes, making exhibits of feathers, twigs, insects, bird houses, egg fillers, insect powder, seed testers, feed hoppers, and so many things of that kind. We had a milk tester and tested milk whenever any one wished us to.

The schoolhouse was near a little ravine where there were plenty of wild flowers and we could visit it every noon when the weather was favorable. I went with them often, and when I did not I encouraged them to find something new to bring back to me. If I did not know what it was, I always did my best to try and find out. A few specimens the children sent to Cornell and were very much pleased to receive a personal letter in regard to them.

So many of the children took to the care of the poultry. From experiences we had at home I could help them quite a little, and there were no other lessons they enjoyed as much as those on poultry. It would take too long to tell you all we did along this line.

Several of my boys kept track of their eggs every day, at the end of the week, and by the month. They could tell you how much they received for them and how much their feed cost. It seems to me that is something worth while for boys twelve to fourteen years old. At noon hour every day that was one of the topics — " How many eggs did you get yesterday?" or " How many little chickens?"

Another little fellow twelve years old took most of the care of the family garden. He has brought me home-grown radishes and onions long before others had them in their gardens. He would have hundreds of cucumbers and several bushels of pop corn to sell every year, besides enough for their own use, which was no small amount for he was one of eight children besides his father and mother.

No one in the district ever objected to the work we were doing that I knew of, but there were many who came to see it and approved of all we did and were proud of it. Our school has been recognized in many ways, and from prizes given at the country fair it has been furnished and is as pleasant a little schoolhouse as most teachers could ask for.

I have been in another district this year, and although we have not done quite as much along this line, because there are not so many farmers' children, still we have accomplished something. We received twelve dollars as first prize at the town fair, and first on a feed hopper, first on a bird house, first on a map, and second on an apron at the grange exhibit.

I expect the children to try to raise better garden products this year as our county fair is doing more to encourage them by offering individual prizes to the children of seventy-five, fifty, and twenty-five cents for the five best onions, five best potatoes, five tomatoes, and many others, besides ten prizes ranging from twenty dollars to five dollars for the best district exhibit.

I have eighteen girls, so am planning to capture some of the prizes in sewing, baking, and such lines if I am wanted and decide to stay this year.

Fredonia, New York

In reply to your letter will state the work done in our school this year.

I find that the work in natural history and elementary agriculture, when carried out whole-heartedly, is not only a stimulus to observation — one of the hardest and most necessary lessons to learn in life — but that it forms a strong bond between teacher and pupil. In this case, have found it to be practically a substitute for discipline. The teacher no longer is the dreaded task-driver and disciplinarian, but a companion and leader. In many cases, the children, some of them, know more about the subject than I do. I have three or four splendid little nature students, who recognize nearly all of the common birds, trees, plants, and flowers. On our trips together all are intensely interested and enthusiastic, and when one of them is able to tell or show me something I do not know, they are very proud.

The children last year had individual flower gardens at school. Last autumn the seeds were labeled and saved, and will be used in this spring's garden. This year we are all planning a flower garden at school and a vegetable garden at home. Each child plans a regular garden (vegetable, some flowers also) at home — only as large as will be well cared for, as too large a garden is discouraging, especially to smaller children. Each child is to make out a real plan for his own garden, said plan to be substituted for an arithmetic lesson.

Regarding the study of animals, we try, when possible and practical, to have one at school for observation. We have done so with the study of doves, rabbits, snails, angleworms, etc. Next week, in our study of sheep, we will observe those of one of the children at his home. During the study of chickens, which lasted about three weeks, besides the regular work, the children gathered statistics from their homes and neighbors of the size, breed, condition of flock, number of eggs laid, feeding rations, etc. We did the same with the study of cows. During the study of chickens, most of the children then planned to set a hen themselves, choosing and caring for the eggs, taking charge of the hen while setting and later of the little chicks, the parents agreeing to give the latter to them. Several of the children are already carrying out this plan.

We have specialized in the study of birds. We have had pictures of all birds mentioned in the syllabus (two cents per copy, A. W. Mumford Company, Chicago) on the walls all winter. From time to time we had certain ones for special study, and descriptions written, and now the children recognize all these birds. Also have a series of tree pictures, showing tree as a whole, leaf, and bark. Several good books on birds, trees, and flowers are on the desk, and those, supplemented by library books, are used by pupils for reference or study, when other lessons are done.

We have a bird and a tree calendar. The bird calendar made out as follows: Bird: Whom seen by; Date; Where seen; What doing. Each pupil seeing a different bird, and recognizing it, puts it down on the calendar, one bird being on calendar but once. We have fifty different birds down since September, but this is a very poor bird locality. The tree calendar is made out somewhat the same. We also have large cardboards on which are pasted the dried leaves of all the common trees of the vicinity. Also a wild-plant calendar. Most of the children now know most of these. When we study a tree, we always have a branch to use in our class, noting bark, leaves, venation, etc.

On our field trips we study especially birds, trees, flowers, wild plants, nests, insects, soil, lay of the land, and such. The children are all very enthusiastic about the trips.

This spring we are planting trees and shrubs on the school yard, which is now practically a bare mudhole. Most of them will be procured from the woods, as the district refuses any expenditures. Next year I will not be here, but the children are planning on carrying out some of the work, although, of course, that depends almost entirely on the next teacher.

The work to me has been a pleasure, and one of a close bond between teacher and pupil. We have all developed observation. Even the smallest child watches closely for something to tell the others about. All the wayside is closely and pleasantly watched by the children.

Fonda, New York

I am writing to tell you how much I enjoy the work in nature study and agriculture; and I know that the boys and girls enjoy it too.

Last year when I began teaching I had the children bring specimens to help the work along. They brought anything which they thought might be of interest in nature study. We had various kinds of leaves, bark, roots, soil, flowers, seed, and even bugs, insects, snails, and a fine lot of frogs in various stages. We had a fine time discussing the most important ones and it surely helped immensely.

Last year we did only a little notebook work. We spent most of our time in oral discussion, and the children in their library work read many nature books, with which the library was well supplied. We mounted and classified our specimens and so kept them longer. The boy who won the prize (given to the one who brought the most specimens) brought over three hundred.

On Arbor Day we asked the neighbors to contribute shrubs, as we had trees enough for the size of our yard. We secured in all a syringa, a rose bush, and three lilacs. We had very good luck with all but the lilacs. Two of them were set in soil which was too clayey, and so they died. We made flower beds and planted seeds in one and set out dahlia bulbs in another. They grew well in spite of the dry weather.

This year I used notebooks and I confess that I overdid the matter. By the time I finished my elaborate notebook work my pupils had no time left for real study. So, I have decided to use notebooks only to help keep observations and pictures in.

This year we have taken many walks for nature study. This helps in geography and nature work both. The children enjoy getting into the fresh air. In good weather we take a walk at least once a week, generally extending our noon a half hour and eating our lunch in the grove where we often go.

We trimmed the trees in the school yard and are planning to rake it and spade up our flower beds on Arbor Day. We each brought three cents, and although there are only eight of us we hope to have a good lot of flowers. We set out a clematis, a spirea, and a California privet which we got from our seed firm. We hope to find quite a few wild vines and shrubs, such as barberry and bittersweet, to set out soon. We are going to have a temporary hedge of castor-oil plants and a border of four o'clocks along our path.

When we started school the flies bothered terribly, so we decided that something practical might be done in the way of fly study. We gave a Hallowe'en entertainment at night and had about forty visitors. We earned enough to buy four good screens and a screen door.

Now I wish we had a porch with a top, so that we could have vines growing over it. I wonder why they seem to try to make country schoolhouses so uninviting? Inside our schoolhouse is very pretty and modern, but outside it is bleak and dreary.

We get the Cornell Rural School Leaflets and have them in our library, as our district superintendent said you had them at your model school.

My pupils are in a potato and corn contest which our district superintendent organized, and they are making great plans for their gardens at home. Our yard is too small for a large school garden, but we are going to plant some radishes, onions, and lettuce for our own use at lunch time.

We had school out of doors one warm, sultry day. There is a grove above the school and it was up there, and the change did not hinder the discipline any more than the heat of the schoolroom would.

I have thought of writing to tell you how much we enjoyed the work, and since your letter I felt more sure that I ought to.

Morrisonville, New York

In my experience as a teacher in the rural school, I have found no trouble in awakening interest in the subject of nature study and agriculture.

No doubt this is largely due to its being a practical subject and one with which the pupils of the rural schools come most closely in contact. I have only about twenty minutes each day to devote to it, but as soon as it is mentioned the most strict attention prevails.

Our school having been fortunate enough to win one of the prizes for the best ear of flint corn this year, has aroused still more interest. The prize ear is carefully cared for by one of the boys and will be used for seed to produce an ear to be sent to the College on next Corn Day (if possible).

Our prize ribbon is framed and hung up in the schoolroom, where it is admired, talked about, and commented on as though it were of unlimited value. The parents show interest as well as the pupils, as I find the case usually. Whatever the pupils show interest in, the parents do, also. I teach the subject to the whole school in general for two reasons: one is, I cannot spare the time for a period for each grade; and the other is, every one is anxious to take part in the talk on nature study and agriculture. Many of the pupils are making preparations for some sort of agricultural work — the boys, farming or gardening, the girls, flower beds.

They look anxiously forward to the time when your leaflets are to be distributed, and find them interesting and helpful.

Granite Springs, New York

We teachers in rural schools who have all the grades have very little time to devote to the nature-study work. The Cornell Rural School Leaflet comes to the rescue, and helps us to make the best use of that little by furnishing the subject matter in convenient form for the teachers and inspiring talks to the pupils.

As a farmer's daughter, the agricultural course appealed to me from the first; both the importance of it, and the fact that the farming instinct is strong in us all, and easily aroused in children.

We use the children's leaflets for supplementary reading, and the children watch eagerly for each number. Can you imagine our delight when we found enclosed in the March leaflet the picture of the very first bluebird we saw this spring sitting on the very same post back of the schoolhouse where we saw him?

The greatest difficulty I find with the children is in keeping them from undertaking too much, and so getting discouraged.

This is my first year in this district, a section that produces milk and apples, and the wild cherry and apple trees along the fences seemed to indicate that many of the farmers who take intelligent care of their orchards were ignorant of the menace in the hedgerows, so I started the children out after tent-caterpillars' eggs.

We have a new, up-to-date schoolhouse, and a fine playground, very little improved. On Arbor Day we shall do what we can in the way of setting out hardy shrubs, and planting a flower bed with such flowers as will bloom in the fall.

Most of the children are ordering a few seeds of flowers or vegetables to plant at home, and one boy of fifteen who never did any garden work before has cleaned up the family garden plot and is starting in to plant and take charge of it.

Last year my pupils, girls as well as boys, did some grafting. They studied how to do it, and just as they were starting out the district superintendent came, and he went with them and set several grafts on pear and apple trees on the school grounds. The grafts lived and the children's parents were greatly pleased.

Pine City, New York

Your letter requesting a statement concerning my work in natural history and elementary agriculture, received. My attitude toward the work is one of enthusiasm over what has been done, and great anticipations for what will be done. This work seems so vividly to be the connecting link between the rural school and the home, and more — it means the difference between hopeless, disinterested, and inert farm life and alert, successful, and nature-loving farm life.

Being only a high school graduate I had not had any textbook training in these subjects, so when I began teaching in September, 1912, they presented a great problem. At first the task seemed hopeless for my program was already overcrowded. Then, too, the people of the district, although they were not antagonistic, were disinterested and skeptical. However, upon studying your Cornell Leaflet, I decided to try to do all that I could whenever possible. It was surprising to find how much time was available, for as soon as the children became interested they talked it continually. We have nature study whenever the opportunity offers itself, as well as correlated with other subjects, and in certain class periods. Noons, recesses, before school, and after school, all are devoted to things the children have found to discuss.

They have, for the most part, been their own teachers, for they are so eager and intent on " finding out " that they pick up bits of information from many sources. I am reluctant to write to you about my work, for I fear you will consider it lacking in method and system. I could not, because of scarcity of time, follow much of a routine, but three things I determined to do — namely, to teach the children to love the work, to teach them to teach themselves to enjoy and appreciate it, and to teach them to teach others to comprehend and desire it.

Birds are our hobby most of all, and the children love to discuss them and their habits. We have two fine bird guides and there is never a day that they are not used by some pupil to find some bird he has seen, some nest he has found, or some bird note he has heard. Last winter we fed chickadees and nuthatches until we could catch them, and, as they usually ate on the window sills, the children were often allowed to go and watch them. Early in this spring we left the schoolroom to watch a flock of robins back of the building. Then and there, despite the fact that other classes had been interrupted, we had the most enthusiastic, live lesson on the robin we have ever had. These little privileges, although a trifle out of the ordinary, make the children more eager than ever, and have a marked effect on their work and the discipline of the schoolroom.

One way the children and parents have been interested is that I seized every opportunity to stimulate and emphasize their work. The children have written one, two, and many of them three, letters to Mr. Tuttle.

Their mounts of work at the county fair last September won prizes amounting to $17.50; and here I might add that, because this was financially argumentative, it won some of the skeptical to our cause. The boys won prizes on poultry, and the girls on bread, at a contest in a near-by school. At Farmers' Week, February, 1914, we had several charts of natural history and agricultural work, and wish to thank you for the blue ribbon that we received and prize so highly. These things I have mentioned counted much in developing and strengthening the work, for they gave that necessary touch to the outside world that made the children and parents feel an interest and pride in their efforts.

As for the effect on the boys and girls themselves, that is the biggest and most worth-while phase of the work. They are more wide-awake, more beauty-loving, more whole-souled, than they could have been without the influences of the glimpses of nature and her wonders. They are more interested in their school work, more alert in their home life, and cleaner boys and girls in their thoughts and conversation.

What teaching these subjects has meant to me, I wish I might be able to tell, so that every teacher beginning the work would not hesitate to put her whole soul in it. It does not take time from other things, it just puts its wholesome sweetness into time that would otherwise be less profitably spent. I felt so woefully incompetent to attempt to teach that about which I thought I knew so little; but as soon as I realized that I, too, could be a pupil, and that great teacher Nature would teach me as well as my children, it has been the most delightful part of my work. I would rather feel that I had opened some of the pages of the beauties of the country to my pupils than that I had taught them all the intricacies of the textbook world. Boys and girls on the farm who love and understand the birds, the trees, the flowers, and the many other charms of their surroundings, are not so ready to leave the farm, but learn to look upon it as a place of enjoyment rather than of drudgery.

As for my plans for next year, they are not very definite as yet for I expect to teach in a graded school nearer the city. However, my intentions are to continue my efforts in this vital movement in the education of the boys and girls in this wonderful work.

Editors' Note.— Following are two letters that were published in the *Camillus Enterprise* of June 19, 1914, one written by a traveler through a country district, the other, an answer to it, written by a taxpayer in the district. Both letters have messages of importance. The rural school mentioned is in the supervisory district of Mrs. Florence Knapp, Onondaga county.

Dear Sir:

While motoring down the lake shore some time ago, a breakdown occurred near a rural schoolhouse. Seeing the door open (although it was a holiday) we went inside the house to await repairs of the car. We were at once attracted to some drawings on the blackboard — which were done in colored crayons and were real gems of art — scenes from fairy tales, and Easter, and other subjects. This was done by the teacher, indeed she was putting drawings on the board at this time. Questioning brought out that she always kept drawings of some sort on the blackboard for the ornamenting of the room, and for the benefit of the children, being of the opinion that these pictures constantly before the child are educating and elevating.

I wondered how many other teachers round about were spending their time on a holiday in the schoolroom — just beautifying it, not necessary, but voluntary, work. Not many, I conjecture. I have been connected with schools for forty years, and know well the almost frantic haste of the average teacher to quit the schoolroom after hours. I wondered if the patrons of that school realized their good fortune in possessing a teacher of that caliber — but I presume they do. This teacher had not merely a training class smattering, but experience.

Another day I purposely called at another rural school, and found that fair work in drawing was to be seen there, also. Now, I am told that an exhibition of drawings from all the schools in this supervisory district is to be held soon in the high school here, and one object in writing this article is to ask the public in to see this work of the children.

In both schools spoken of I found drawings wonderfully well done by children of all ages. The average person would not believe children could draw so well.

I bespeak a treat for any one who has sufficient interest to look in at the high school on the day of the exhibition.

W. B.

Dear Sir:

As a resident in the rural school district spoken of by " W. B." in the article " An Artist Teacher," I feel that all the good words should not be spoken by a stranger, also that " the half has not been told." Why should not any one appreciate the teacher, when the children have learned more in this year than in any two before — not alone book learning, but in stories of history, anecdotes of great men, and general information? Some fads have been left out and practical things studied. For instance, the children are required to measure the grain bins in their barns and figure out what they will hold. A Babcock tester is brought into the schoolroom, and milk is tested for butter-fat. Beans and peas and other seeds are planted in boxes of sawdust, and their growth watched every day. Frogs and toads are kept in pails; their eggs are hatched and the growth of tadpoles watched every day. Worms spin their cocoons in bottles on each child's desk. Bird houses are made (three) and fastened in the tree. Shrubs, vines, and flowers have been planted. The boys are taught to touch their hats to the passers-by. These are a few of the many reasons why we consider ourselves fortunate in having an artist-teacher, as well as a practical one.

TAXPAYER

Editors' Note.— As soon as a taxpayer speaks for education, every one in the community will listen. It is gratifying to know that the New York State taxpayers are rising to their responsibility.

THE DISTRIBUTION OF THE CORNELL RURAL SCHOOL LEAFLET

THE EDITORS

As the demand for the Cornell Rural School Leaflet constantly increases and many persons are newly added to the lists each year, it may be well to describe briefly the methods employed in distributing the publication.

The first number of the leaflet for each school year is published in September and is known as the September, or subject-matter, leaflet. It reaches all teachers of elementary grades without individual request on their part. The names of all teachers under rural supervision are obtained at the earliest possible date from the district superintendent, and a copy of the September leaflet is sent directly to each teacher. Grade teachers in cities and villages having a superintendent of schools receive the leaflet from their superintendent, to whom copies are sent in bulk for distribution.

Every teacher in New York State below the high school is entitled to a copy of the September leaflet. In the case of teachers under city or village supervision, this is the only leaflet available to them during the year. In the case of teachers under rural supervision, additional copies of the Cornell Rural School Leaflet are available. They may be obtained as follows:

Accompanying the September teachers' leaflet will be found a blank form for the names of pupils. This blank should be filled out immediately and returned to Miss Alice G. McCloskey, College of Agriculture, Ithaca, New York. The pupils' names will then be placed on file and each teacher will be sent a sufficient number of copies of the leaflets for boys and girls to supply the school. We hope to send three leaflets for children — one in November, one in January, and one in March. These are distributed to the pupils by the teacher.

To summarize: In order to perfect our method of distribution, teachers in elementary schools should remember the following:

1. A copy of the September number of the Cornell Rural School Leaflet for teachers will be received through the mail early in the school year.

2. A blank accompanies the teachers' leaflet, which is to be used only by teachers of elementary grades under the supervision of district superintendents of rural schools. (See page 1557.)

3. The blank should be carefully filled out with the name and address, district number, township, county, name of district superintendent, and names of pupils.

4. The blank should be returned at once to Miss Alice G. McCloskey, College of Agriculture, Ithaca, New York.

5. Three times during the year a package of children's leaflets will be received through the mails.

6. These leaflets should be distributed to the pupils whose names were on the list sent.

7. Any changes of teacher or pupils in the school should be reported in detail at once, in order that the records at the College of Agriculture may be complete and accurate, thus enabling prompt, correct, and effective distribution of the Cornell Rural School Leaflet.

DISTRIBUTION IN 1913–1914

It may be of interest to teachers and others to examine the following report of the distribution of the Cornell Rural School Leaflet last year:

Persons receiving leaflets	
Rural teachers	14,862
City and village teachers	27,643
Training-class pupils	1,672
Training- and normal-school pupils	1,425
Pupils in rural schools	172,078
Total	217,680

Number of copies distributed	
Total rural teachers (two numbers)	29,724
9393 teachers who returned lists of pupils (three additional numbers)	28,179
City and village teachers (one number)	27,643
Training classes (five numbers)	8,360
Training and normal schools (one number)	1,425
Pupils, 172,078 (three numbers)	516,234
Total	611,565

REFERENCE BOOKS

1. Nature-Study and Elementary Agriculture

Nature-study leaflets (bound volume). Extension Department, College of Agriculture, Ithaca, New York	$ .30
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IMPORTANT NOTICE

READ CAREFULLY ARTICLE ON PAGE 269

Two or three leaflets for boys and girls will be sent during the year to elementary schools under rural supervision. We have not sufficient funds to send children's leaflets to city schools.

Your boys and girls should have the leaflets. Please write their names and the other information called for on this sheet and send it to

(Miss) Alice G. McCloskey
College of Agriculture
Ithaca, New York

Approximate number of egg clusters of the apple-tree tent-caterpillar destroyed by the school last year ....

Size of the school ground, in feet.................by..................

Is there adjacent property that could be added?..................

Teacher's name ....

Post-office address ....

....

Number of school district..................

Name of township..................

Name of county..................

Name of district superintendent..................

Number of teachers in the school..................

Number of pupils in your charge..................

NAMES OF PUPILS

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3.................. 9..................

4..................10..................

5..................11..................

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HOUSEHOLD INSECTS AND METHODS OF CONTROL

GLENN W. HERRICK

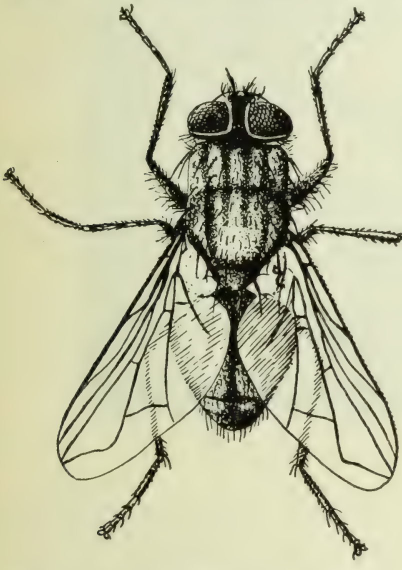

FIG. 1.— *An adult house fly. Much enlarged**

Some one has rather facetiously remarked that, from a zoological standpoint, the present age may be called the age of insects. There is really more reason in the foregoing statement than might appear at first sight. When we recall that the species of insects outnumber the species of all other animals combined; that the insect pests in this country alone cause a loss of over a billion dollars annually; that several hundred trained men in the United States are giving their entire time to a study of these pests; and when we realize that thousands of letters are sent each year to our government agencies, requesting information regarding insects and means of fighting them — we are more than ever impressed with the importance of the relation to man of these tiny, but multitudinous, forms of life. Until within the last few years the economic importance of insects was due mainly to their indirect injuries to man through attacks on the things that he produces. Suddenly, almost within the last decade, insects have assumed an entirely new and exceedingly important significance through their direct injuries to man himself.

Since the epoch-making discoveries that mosquitoes carry malaria and yellow fever, insects, especially those frequenting the household, have assumed a most unexpected importance. The hum of the mosquito and the buzz of the house fly have become fraught with an entirely new significance. Even the dog and the cat, with their burdens of fleas, have taken on a new aspect and appeal to us from an entirely new viewpoint. The kitchen drain, the open cesspool and closet, the barnyard manure pile, the horse stable, and the hog pen present entirely new problems to the occupants of the farm home through the insects that originate in them. One neglected manure pile can furnish enough house flies to overrun several households all the summer through. An open kitchen drain can afford breeding-places for enough mosquitoes to change pleasant summer evenings into hours of torment and displeasure.

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*The drawings for this lesson, with the exception of Figs. 2, 5, 6, 10, 11, 12, and 14, were made by Miss Anna C. Stryke.

In the following pages the writer has attempted to point out some of the relations that certain insects bear to the human inmates of households. Suggestions have also been given of the most practicable methods of preventing the injuries caused by the small pests. No attempt has been made to treat of all the insects that may invade the household, only a few of the most important ones being discussed. Other insects may sometimes enter our houses and cause annoyance or injury, but they are usually of minor importance compared with those discussed in this paper.

THE HOUSE FLY

(*Musca domestica*)

There are no more universally annoying insect pests than house flies. They are present from early spring until late fall, even remaining far into the winter. They are most annoying in kitchens and dining-rooms because of their abundance, their proneness to get into food, and their generally filthy habits. Until comparatively recent years the house fly has been regarded as a scavenger, of value to humanity because of its aid in the removal of wastes that are a menace to human welfare. The eggs of the house fly are often deposited on decaying vegetable matter that has been allowed to accumulate in the vicinity of human habitations, and the maggots, which hatch from the eggs, live on this decaying matter and aid in destroying it. Thus it must be conceded that house flies do assist somewhat in the removal of foul and dangerous waste matters and, to this extent, are a benefit. On the other hand, it has been conclusively shown that house flies carry the germs of cholera, typhoid fever, cholera infantum, and tropical dysentery, on their feet, legs, and bodies and in their digestive tracts. There can be no doubt of the responsibility of the house fly for much sickness and many deaths.

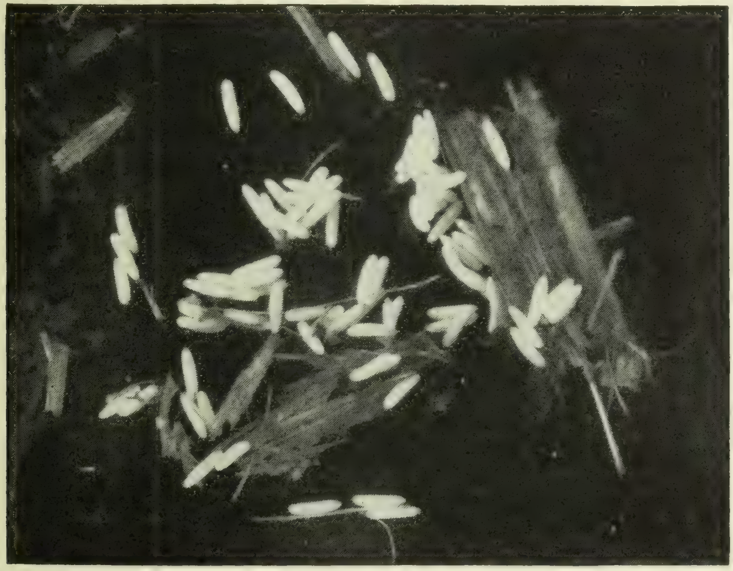

Fig. 2.— *Eggs of a house fly. Enlarged*

The life history of a house fly

In all its phases and instincts the house fly seems to be a lover of filth. Its eggs are usually deposited in manure, preferably in horse manure whenever this medium can be found. Sometimes they are laid on cow manure and often on human excrement, especially in open closets, and on other decaying animal and vegetable matter. A female fly may deposit 120 to 150 eggs at a time, and since she has been observed to make four deposits in her lifetime it may be concluded that a single fly is capable of laying at least six hundred eggs.

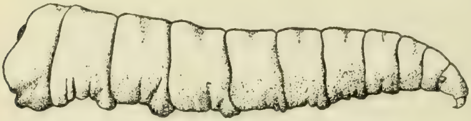

FIG. 3.—*Larva, or maggot, of a house fly. Much enlarged*

The egg is a small white object, about one twentieth of an inch long. In shape it resembles a grain of wheat except that it is more pointed. The eggs are usually deposited in clusters (Fig. 2). They hatch in eight to twenty-four hours, according to the temperature.

The larva, or the maggot, is whitish in color, pointed at the head end, blunt at the opposite end, and about one third of an inch in length when mature (Fig. 3). It grows rapidly, molts three times, and reaches maturity in six or seven days under favorable conditions.

The pupa, enclosed in the last cast skin of the larva, rests quietly for a few days, and then its dark enveloping case breaks open and the adult fly emerges.

At the height of the summer season a generation of flies may be produced in ten to fourteen days. In the latitude of Washington, D. C., there might be time for fourteen or fifteen generations during a season, while in New York there would be time for scarcely more than nine or ten generations. It has been estimated that the progeny of a single female fly at the end of the ninth generation may reach the enormous number of 1,953,000,000 female flies, to say nothing of all the males produced which are equally efficient carriers of filth and disease germs.

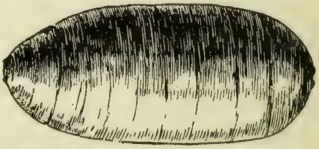

FIG. 4.—*Pupa of a house fly. Much enlarged*

Where flies breed

The main breeding-places of house flies are in piles of stable manure, especially horse manure, in rotting straw and manure lying in stables and barnyards, in the kitchen refuse of garbage cans and barrels, in manure piles about pigpens and poultry houses, in human excrement lying in the pits of loose or open closets, and, in fact, in almost any decaying vegetable matter that lies long enough in one place to ferment and decay. The fact should be emphasized that the most dangerous breeding-place for flies is in open closets; for in these places the germs of typhoid fever, dysentery, and cholera infantum are found. By all means the pits of closets should be tight and dark so that no flies will enter them; and the contents should be kept covered with fine ashes or dirt. In addition, the pits should be cleaned rather often and the contents carefully buried far from wells and springs of water.

The adult fly and its habits

There are several kinds of flies that frequent the rooms of dwellings, some of them smaller than the house fly and some larger. The house fly is about one fourth of an inch long, and the body and legs are covered with many hairs and bristles. The top of the thorax (Fig. 1) is dusty gray in color and bears four dark, longitudinal stripes. The house fly has two thin membranous wings, on each of which the fifth long vein turns abruptly upward near the end. Each foot of the fly is furnished with two pads, or *pulvilli*, and each of the pulvilli bears many tiny hairs which secrete minute drops of a sticky liquid that holds the fly to the ceiling on which it walks. The hairs on the body of a fly and the sticky foot pads entangle and gather up myriads of germs from all sorts of filthy places. Moreover, the fly distributes these wherever it goes, for it is constantly wiping its feet on everything that it touches.

The mouth parts of the fly form a proboscis, on the end of which are two lobe-like organs called the oral lobes. Each lobe bears on the underside many transverse ridges, or false tracheæ, that fit it for a rasping organ. When the fly finds a solid substance such as a grain of sugar, it applies the oral lobes to the food, sends out some saliva to dissolve the solid material, and then gradually sucks the solution into the mouth.

The relation of the house fly to disease

It has now been definitely proved that house flies carry, both externally and internally, certain disease-producing germs. For example, several observers have found that the bacilli of typhoid fever may be carried on the feet, legs, and bodies, and in the alimentary canals, of flies. The typhoid bacillus has been recovered from flies caught in privies.

The bacilli of cholera also have been found in great numbers on the bodies of flies, and it has been shown that flies will carry the germs to milk. It is also held that the house fly may carry the bacillus of tuberculosis and deposit it on food. It is certain that flies feed on sputum deposited on walks and in similar places. House flies are charged also with the distribution of the germs of cholera infantum and other juvenile intestinal diseases. Doctor Jackson has adduced considerable evidence in support of this view.

These insects are especially dangerous as agents in the dissemination of disease because they are fond of all human foods, both liquid and solid, and because they are restless, active insects, traveling extensively and flitting from place to place with considerable rapidity. As it has been said, "In the course of a few moments a single fly may crawl over human or other excrement, sip from a glass of milk or water, and merrily chase across a dish of mashed potatoes, or other human food."

Typhoid fever and its relation to the house fly

The relation of the house fly to typhoid fever is considered the most important phase of the germ-carrying powers of this insect. In order to understand and appreciate this relation clearly, something of the nature of the fever and the typhoid bacillus, or germ, should be known.

Typhoid fever is a so-called enteric disease; that is, it is caused by a bacillus, or germ, that enters and lives within the intestines of the affected individual and causes the ulceration of these organs. The bacillus affects other organs also, especially the kidneys, and its presence, together with a poison that it excretes, produces conditions that give rise to the characteristic symptoms of typhoid fever, namely, an increasing and fluctuating temperature, rose rash over the abdomen, diarrhea or the opposite, and occasionally hemorrhages of the bowels. The peculiar and vitally important thing about the bacillus causing this disease is that it may be present in the alimentary canal of a human being for some time before the person becomes ill, and that it may remain long after the patient has entirely recovered. Moreover, the bacilli, when present, may be given off in the feces and the urine. Thus, a patient may be giving off the bacilli of typhoid fever for days before being confined to the bed, and for weeks or months, or even years in the case of "walking typhoid," after recovery. If the feces or the urine containing the bacilli are deposited where they are accessible to flies—in open privies, for example—the chances are many that the germs will be carried on the bodies and the feet of the insects to kitchens and dining-rooms and be deposited on food. During the Spanish-American war, flies were traced by their whitened feet from the lime-sprinkled, open latrines, or privies, to the dining-tables of the soldiers.

It makes one shudder to think of the thousands of open closets in country districts and towns of the United States to which flies have access and in which they breed, and from which they may come directly to our kitchens and tables.

Methods of control

Treatment of manure piles.— Chlorid of lime, at the rate of one pound of lime to eight quarts of manure, will kill the maggots if it is thoroughly mixed with the manure. Unfortunately, this treatment is expensive; the chlorin fumes from treated manure irritate the eyes of live-stock, and it is not certain whether or not the chlorid of lime destroys the fertilizing value of the manure.

Kerosene oil will kill the maggots, but too much of it is required for its use to be economical. Lime has been used for this purpose and has not proved an efficient destroyer of the maggots.

It has been found by J. J. Davis that a solution of iron sulfate, two pounds in a gallon of water, or two and one half pounds of dry sulfate per horse each day, will kill the maggots when mixed with the manure. Iron sulfate is so cheap that it will not cost more than two cents per day for one horse; and in addition it will completely deodorize the manure.

The storage and removal of manure.— It has been shown that flies prefer light, open places in which to breed and that they rarely enter dark rooms to deposit their eggs. It is therefore wise to build a dark, well-screened room or a tight cement pit in which manure can be stored for a long time or from which, if preferred, it can be removed once or twice a week. In the country, where it is preferred to remove the manure once or twice a week rather than to store it, it should be drawn to the fields and scattered thinly over the surface. If the manure is left in piles or in large lumps there is still danger of its serving as a breeding-place for flies.

The box privy.— Flies that come from the privy are the most dangerous. Not only do they bring germs to our tables, but they are likely to contaminate the milk that may be used for feeding children.

There is no longer any excuse for the old, open box privy, cleaned once a year. It is a menace to the whole household and to the neighborhood as well. The pit must be fly-proof and, in addition, the contents should be carefully covered each day with a liberal supply of fine road dust or sifted ashes. Finally, the pit should be emptied as often as possible and the contents should be buried far from wells and springs of drinking water.

Fly traps.— Every one is familiar with the different types of wire fly-traps. Many of them are excellent and their use is recommended.

Insect powder.— A powder known as pyrethrum, Persian insect powder, or buhach, is sold for killing all kinds of household insects. Buhach is a California product and is more likely to be fresh than the imported Persian product. There is no more satisfactory way of ridding a kitchen of house flies than by the use of this powder. At night all the doors and windows of the kitchen should be closed; fresh powder should be sprinkled over the stove, on the window ledges, tables, and in the air. In the morning flies will be found lying around dead or stupefied. They may then be swept up and burned.

Bichromate of potash.— This is a substance often used for killing flies. It is not a virulent poison and little danger is incurred in putting it about the room. It should be dissolved in water at the rate of one part of potash to two parts of water, and should then be set about the room in shallow dishes. If the room can be darkened with the exception of one window, and the solution placed on the ledge of this window in the light, quicker results will be obtained.

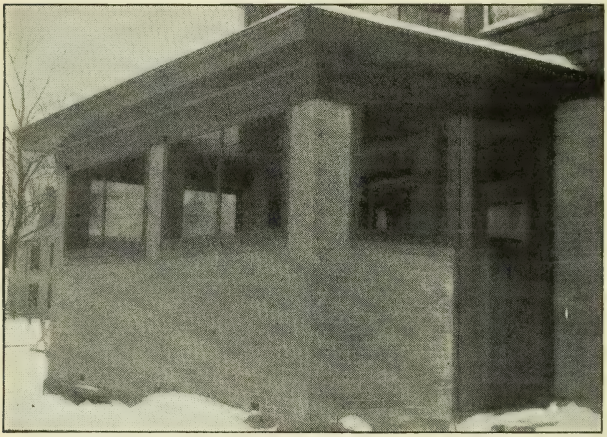

FIG. 5.— *A back porch that is well screened*

Formaldehyde.— One of the best solutions for attracting and killing flies is a dilute mixture of formaldehyde (40 per cent) and water. Two tablespoonfuls in a pint of equal parts of milk and water, set about the room in plates, will attract the flies and kill many of them, provided there is no other food or water for them to feed on. A piece of bread placed in the middle of each plate for the flies to alight on will make the bait more attractive.

Fly papers.— Tanglefoot fly-papers should be in use in kitchen and dining-room if flies are present. No fly should be allowed to live in any kitchen a minute longer than is absolutely necessary to provide means for its destruction.

Screens.— If we could eliminate all the breeding-places for flies we should be free from them. This is too much to expect at present and the screening of windows and doors seems necessary.

Flies enter a house largely through the back door leading to the kitchen. They are attracted to this opening by the odor of cooking food and by the warm air pouring outward when the door is opened. This is especially noticeable toward night on a wire gauze door if the main door is left open. The wire screen is often literally black with flies, and whenever it is opened some of them are almost sure to enter. Moreover, this door is opened probably more than any other in the house. The only efficient method of keeping flies out of the kitchen is to build a porch (Fig. 5) over the back door and screen the three open sides. Of course, a wire gauze door must be placed in one side wherever it is most desired. With this arrangement the flies cannot gather on the screen door of the kitchen, and they do not gather on the porch screen door in such vast numbers because less warm air and odor is present there.

THE CLUSTER FLY

(*Pollenia rudis*)

A word should be said about the cluster, or bunch, or honey, fly, as it is variously called. This fly is slightly larger than the house fly and appears longer and narrower. It is familiar to most housekeepers because of its habit of entering houses in autumn and hiding away in protected nooks and corners in large clusters. Clusters may be seen in the corners of a room, beneath garments hung in closets, and behind curtains at darkened windows. The cluster fly is an annoyance because of its habit of specking and spoiling the wall paper.

Normally, the cluster fly lives out of doors, frequently on the flowers and fruits of plants. In the autumn, however, it enters dwellings in search of snug retreats in which to pass the winter. It seems to frequent unused and darkened rooms; the writer has never seen it in any abundance in light, much-used rooms.

Methods of control

Screens are of no use in keeping this fly out of a room. It will find cracks and crevices beneath the clapboards and around the window casings, through which it may crawl in spite of all that can be done. The most feasible plan of controlling the species is that given by one of our correspondents, who says: " The only way I have found to keep them out of the room is to leave out screens, lower the windows from the top, and have the room light." As cold weather sets in the clusters of flies may be swept up and burned.

Fresh pyrethrum or insect powder, dusted freely on the clusters of flies, will paralyze and kill them so that they may be swept up and burned.

THE MOSQUITO

The mosquito is really a kind of small fly, not unlike the house fly except in size and in its power to "bite." Mosquitoes are no more abundant to-day than they were one hundred years ago; but much greater interest is shown in them nowadays than formerly because of their relation to certain diseases. There are known to be over five hundred different kinds of mosquitoes in the world; over sixty species occur in the United States. Not more than half a dozen of these are at all common about our houses; only three of them are known to carry malaria, and only one is concerned in disseminating yellow fever.

Mosquitoes are found in both salt and fresh water. Areas of greatest infestation by these pests are usually found along seacoasts; and the salt-water species differ from those breeding inland in the fresh waters. Many of our common inland species of mosquitoes belong to the genus *Culex*. So far as is known, none of these are disease-carrying. There are several species belonging to the genus *Anopheles* in the United States, but apparently no one of these species is capable of carrying all the different types of malaria. Finally, there is one species of mosquito, *Aëdes calopus*, that has been proved to carry yellow fever.

Life history of a common mosquito, Culex

Throughout the interior of the United States probably the house mosquito, *Culex pipiens*, is the most common. As far as is known, it transmits neither malaria nor yellow fever, but because it is so well known it serves as an example of the manner in which mosquitoes live. It breeds in almost every place in which fresh water may be found: in quiet pools, roadside ditches, hollow stumps, rain barrels, cisterns, tin cans, watering troughs, and similar receptacles for water.

In the autumn the adult mosquitoes hide away in cellars, barns, outhouses, or other suitable places, and there pass the winter in a dormant condition. Probably the majority of these hibernating mosquitoes die before spring. Those females that survive the winter become active in early spring, and after feeding, or sometimes without obtaining food, they seek a convenient pool of water on which to deposit their eggs.

Eggs.— The eggs of the house mosquito are laid on the surface of the water in more or less boat-shaped masses (Fig. 6, *d*). Each mass contains 75 to 300 eggs. When first laid the eggs are yellowish white, but a little later they become dark brown in color and appear as small masses of soot floating on the water. Before hatching, the eggs float on the surface of the water for twenty-four hours to several days, according to the temperature.

Larva.— When the egg hatches, there issues from its lower end a tiny larva, or "wiggler." Wigglers are often found in rain barrels in great abundance. The larva of the house mosquito rests for the greater part of the time with the tip of its abdomen at the surface of the water and the head hanging downward at an angle of about forty degrees. At the tip of the next to the last abdominal segment is a long tube, known as the respiratory tube (Fig. 6, *g*). It is through this tube that the larva takes in its supply of air, and this accounts for its position with the tail end up so that air may be drawn through the tube. The wigglers live on bits of plants and vegetable matter that they find in the water, and after five to ten days they transform to the pupal stage.

Pupa.— In hot weather, at the end of a week to ten days the larva changes to another form that is called the pupa (Fig. 6, *h*). The pupa lives in the water and wriggles about much as the wigglers do. The pupa is mostly head and thorax, with but a slender abdomen. The breathing apparatus now consists of two respiratory tubes instead of one, which are situated on the thorax instead of on the abdomen. After the pupa has lived for five or six days, it changes to the adult mosquito.

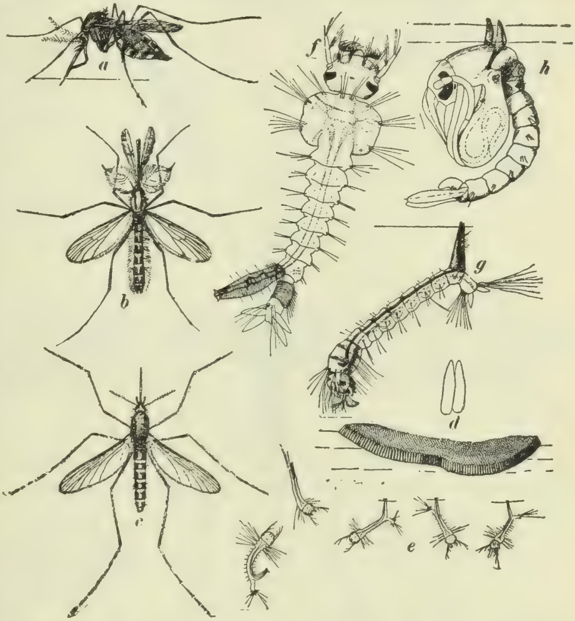

FIG. 6.—*Life story of a Culex mosquito: (a) and (c) females; (b) male; (d) eggs; (e) young "wigglers"; (f) full-grown larva, or "wiggler"; (g) larva in feeding position at surface of water; (h) pupa. All enlarged. (Adapted from Howard)*

Adult.— The full-grown mosquito has two wings and a slender body. Although the male often enters the house, he does not bite nor annoy us; it is only the female that bites. The male may be distinguished from the female by the brushes of hairs on the head.

Life history of a malarial mosquito, Anopheles

The malarial mosquitoes belong to the genus *Anopheles*, and we shall speak of them simply as *Anopheles*. The one species in the United States that is known to be a more general carrier of malaria is widely distributed. Its technical name is *Anopheles quadrimaculatus*. Like the common house mosquito, the life history of *Anopheles* is made up of four distinct stages.

Eggs.— The eggs of *Anopheles* are laid singly and at random on the surface of the water, although they naturally run together and cohere in loose, irregular groups, or strings, of three to a score or more. The egg differs greatly in shape from that of *Culex*. As seen from the side, the egg of *Anopheles* is canoe-shaped.

Larva.— The larva of *Anopheles* lies in a horizontal position, apparently on the surface of the water. In reality it is just beneath the surface film. The breathing tube is very short; hence the larva has to lie close to the surface. The larva of *Anopheles* can be recognized at once by the position that it assumes in the water. It should be remembered that the larva of *Culex* hangs at an angle of forty degrees, with its head downward.

Pupa.—The pupa is not strikingly different from that of the house mosquito except that the breathing tubes on the thorax are somewhat shorter.

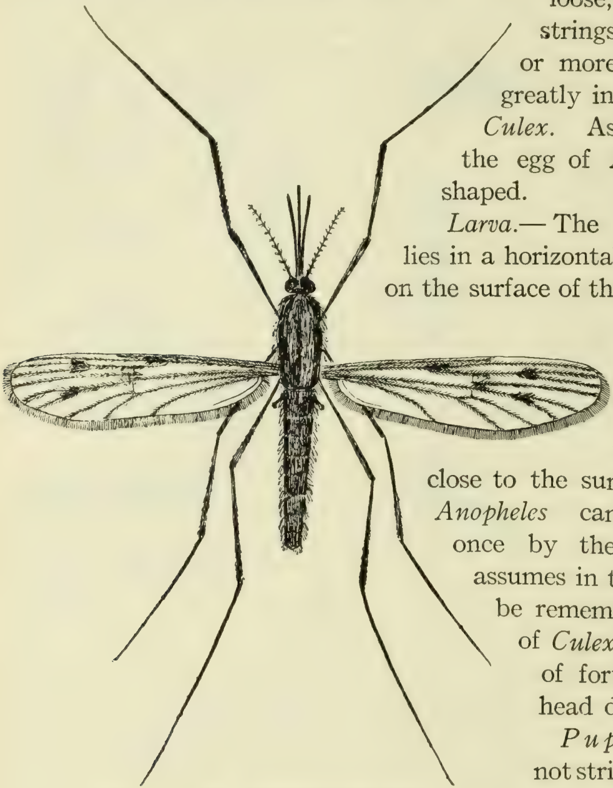

FIG. 7.— *An Anopheles mosquito*

The entire life cycle of *Anopheles* occupies eighteen to twenty-one days in warm weather.

Adult.— The full-grown *Anopheles* is somewhat larger than *Culex*. The wings are heavier and present a spotted appearance, owing to distinct patches of white scales (Fig. 7).

The female *Anopheles* bears three long, slender projections on the head, while the female house mosquito has but one (Fig. 8). Moreover, when the house mosquito alights its body is held parallel to the surface, whereas the body of *Anopheles* usually rests at a considerable angle to the surface on which it alights.

Anopheles rarely breeds about the house, but chooses a ditch, a pool, or the shallows of a spring, brook, creek, or river for a breeding-place.

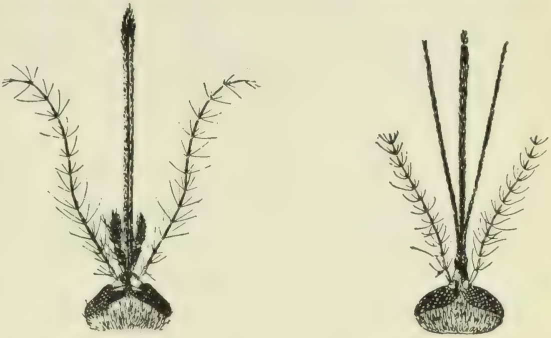

FIG. 8.— *Head of female Culex (left) and female Anopheles (right)*

The yellow-fever mosquito (*Aëdes calopus* Meig.)

The mosquito that carries yellow fever is found only in the warmer countries of the world and is common in the southern part of the United States, certainly as far north as Virginia. In past years there have been epidemics of yellow fever in New York City and in Philadelphia. It would therefore seem that this mosquito must have occurred as far north as these cities. Its occurrence, however, at these northern points was only temporary during the warm summer season. With the advent of frost the adults are killed.

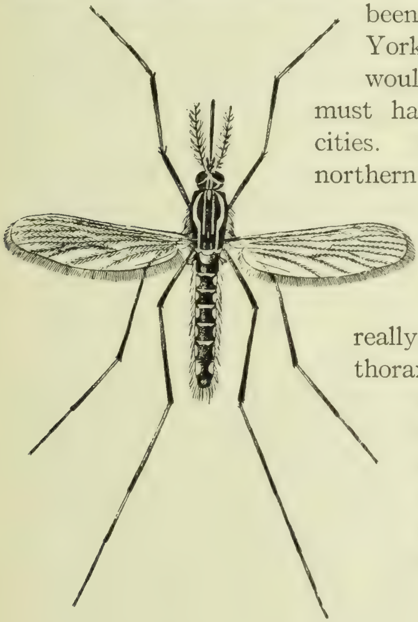

FIG. 9.— *Yellow-fever mosquito*

The yellow-fever mosquito is a really handsome insect (Fig. 9). The legs, thorax, and abdomen are banded with conspicuous silver stripes. The black eggs are laid near the surface of the water in cisterns, rain barrels, and other receptacles, where the wigglers may be found. The life cycle occupies ten to eighteen days.

The bite of a mosquito

The beak of a mosquito is made of six bristle-like, or lance-like, organs inclosed in a sheath. The bristle-like organs are the puncturing parts of the beak, for the sheath does not enter the flesh when a mosquito bites.

While the mosquito is puncturing the skin, an irritating poison, the chemical nature of which is not known, is injected into the wound. This poisonous substance causes an itching sensation. The immediate area turns red and becomes inflamed, and in the case of some persons much swelling follows. The itching and irritation may be relieved by the application of dilute solutions of ammonia, a five-per-cent solution of carbolic acid, or a one-per-cent lotion of menthol.

Methods of controlling mosquitoes

The best way to get rid of mosquitoes is to drain or fill up the ponds, pools, or other bodies of water in which the insects breed. Old tin cans, pails, or other useless receptacles that may hold water should be turned bottom side up or drawn away far from the house. Rain barrels and tanks may be covered with galvanized wire netting, at least fourteen meshes to the inch, so as to prevent the mosquitoes from laying their eggs on the water.

In many cases ponds, pools and tanks that cannot be drained may be sprinkled with kerosene oil every two weeks during the summer. The oil spreads over the water in a thin film and prevents the wigglers from obtaining air through their breathing tubes; consequently they are drowned. Furthermore, the oil kills the eggs and prevents the female mosquitoes from depositing any more.

In case of those pools and tanks that cannot be drained or that it is not desirable to cover with oil, fishes may be introduced which will destroy the wigglers. For example, goldfish, sunfish, or certain minnows serve to keep pools free from mosquitoes.

The use of bed nets

But in spite of our best efforts there are always a few mosquitoes in certain regions. One good method of escape from them is by the careful use of bed nets. If a net is arranged so that it does not hang in folds and is not too low and close to the sleeper, little air is excluded. In order to be serviceable, a net must be free from rents and large enough to reach the floor on all sides of the bed. A bobbinet bar, closed on all sides, makes an ideal net. Care should be taken not to allow mosquitoes to enter the net with the sleeper, and the edge of the net must not catch on the bed rail or cover and remain off the floor during the night. If one must travel in a malarial region infested with mosquitoes, a light net should always constitute a part of the traveling outfit and have its place in the bag with other necessities.

Going indoors early at night

It is now known that night air does not carry miasma or malaria; but it is just as important to remain in the house at night as it ever was, because mosquitoes are particularly active after dark. Therefore, in order to escape the bites of *Anopheles* mosquitoes and the accompanying malaria, it is important to remain indoors after dark or to have the sitting porches closely screened.

Repellents for adult mosquitoes

Various mixtures, oils, and ingredients are used for repelling adult mosquitoes. Oil of citronella is said to be an efficient protection, but its efficiency will not long continue at most, and it is not to be relied on during a night of sleep. It is mainly useful while one is sitting on porches or in rooms where mosquitoes are troublesome.

The following mixture is recommended: cedar oil, one ounce; oil of citronella, two ounces; spirits of camphor, two ounces. A few drops of this mixture on a cloth hung on the bed will keep mosquitoes at a distance and will be effective for a long time.

THE BEDBUG

The bedbug has apparently been associated with man as long as man has slept in beds. This insect was well known to the Romans, who gave it the name *Cimex*. Pliny wrote of its medicinal qualities and especially recommended it for snake bites. The general name "bedbug" is given to this insect all over the United States. In parts of the South it is also known as the "chinch." In New York City the pests are called "red coats," while in Baltimore they are given the aristocratic title of "mahogany flats."

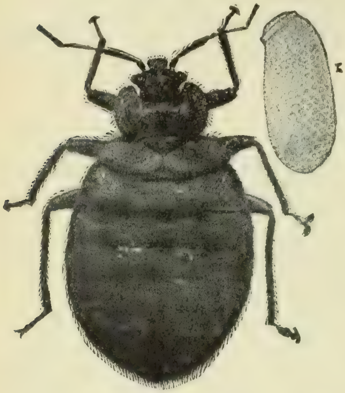

FIG. 10.—*The bedbug and its egg. Much enlarged*

The bedbug is a member of the group of insects known as the *Hemiptera*. Included in this group are the stinkbugs, pumpkin bugs, squash bugs, and many others, which possess certain glands in the body that secrete an oily, volatile, ill-smelling fluid. Probably in most of the bugs the secretion serves as a means of protection. In the bedbug, although it may be useless now as a weapon of defense, it remains and produces the well-known "buggy" odor.

The bedbug has piercing and sucking mouth-parts. The underlip is greatly lengthened and the edges are rolled upward until they nearly meet on the top, thus almost forming a closed tube that constitutes the so-called beak. Inside the tube, or beak, are four long, slender, thread-like organs that move over one another with a gliding, alternating motion that enables them to pierce and lacerate the flesh and set the blood free. The whole apparatus serves also as a tube to conduct the blood to the mouth.

The body of the bedbug is flat and wide, a character that fits it wonderfully well to the place that it has chosen for its home. The cracks and crevices of bedsteads furnish admirable protective retreats for an insect with a flat, thin body. Moreover, the bedbug has no large wings to get in its way and encumber its retreat.

Dissemination of the bedbug

It is often puzzling to know how these insects become established in a house. One of the most prevalent ways is on laundry brought in by the washerwoman. The writer has repeatedly seen bedbugs come in on the weekly laundry. In several instances the insects were seen on the white spread of a bed where clean clothes had been laid by the laundress.

If the members of a family travel considerably they are likely to bring the pest home in their trunks and handbags. Guests who have been traveling and stopping at various hotels often unwittingly become the source of infestation by bringing the pest in their baggage. In towns and cities, where houses are built close together, bedbugs will actually migrate from one house to another.

The food of the bedbug

Undoubtedly the bedbug prefers human blood to all other food. Some authorities maintain that this insect can subsist for a time on the juices that it may be able to extract from moist wood or from accumulations of moist dirt in cracks and crevices of floors and walls. The writer is unable to find conclusive evidence, however, that the bedbug will accept any substance as food other than blood. Bedbugs have been kept alive for months without food, which serves to prove that they may exist in unoccupied houses for a considerable length of time.

Girault and Strauss have found that, under certain conditions at least, bedbugs will attack living mice and will gorge themselves with the blood of these animals. Perhaps it is not too much to suppose, in the light of this knowledge, that these insects might eke out an existence in deserted dwellings for a considerable period of time if mice were present to serve as occasional hosts.

Life history of the bedbug

The eggs of the bedbug are white and are oval in shape. They are laid in cracks and crevices, in batches of a few to forty or fifty, and hatch within a week or ten days. The young bugs are white and tender in appearance. The little bugs grow and, it is said, shed their skins five times before they become fully grown. Girault, in his rather extended experiments on the bedbug, has found that the length of time taken for the young insects to become mature varies greatly and depends on the temperature and on the food supply. Apparently, when the temperature is favorable and the young bugs are able to find plenty of food, they will mature in six or seven weeks.

Relation of the bedbug to disease

The bedbug is under grave suspicion as an active agent in the transmission of several diseases, but it is difficult to prove him guilty. It is thought that the bedbug may transmit Obermeyer's relapsing fever, a disease occurring in Europe. Dutton has also shown, experimentally, that the bedbug may spread typhoid fever. When certain bugs were infected by feeding on the blood of a person in the acute stage of the fever, they retained bacilli in a virulent condition for at least twenty-four hours. R. E. Riggs has adduced some later evidence of the relation of the bedbug to this fever.

It is extremely desirable to avoid the bites of this insect, especially in hotels where beds are occupied by so many persons.

Control of the bedbug

In the first place, iron or brass bedsteads are much more desirable than wooden beds in a fight against this pest. The former offer few cracks and crevices, and these are easily reached.

The old-fashioned remedies, such as kerosene oil, gasoline, or benzine, when forced into cracks and crevices with a hand syringe or a feather, are still among the most efficient weapons against the bedbug. The treatment must be thorough and should be made several times in succession, with intervals of three or four days between applications in order to give time for any untouched eggs to hatch.

A mixture of one ounce corrosive sublimate, one pint alcohol, and one fourth pint spirits of turpentine, painted in the cracks of a bedstead with a feather, is another old-fashioned and effective remedy.

Boiling water, poured over the parts of a bedstead after they have been placed where they may be liberally treated, will kill both eggs and bugs. Of course, boiling water should not be used on highly polished or on varnished furniture.

Sulfur has been used with success by some persons. Not less than two pounds of sulfur to every one thousand cubic feet of space should be burned, and the rooms should be tightly closed for several hours. In order to close the cracks around windows and doors, strips of newspaper may be soaked in water and applied rapidly over the cracks. They will stick tightly for many hours. The sulfur should be placed in a kettle set on bricks in a tub of water so as to avoid danger from fire. A half teacupful of wood alcohol poured on the sulfur and then lighted will serve to burn the sulfur completely.

It must be remembered that sulfur fumes bleach certain colors in wall papers and fabrics, and tarnish metals of various sorts.

Fumigation by means of hydrocyanic acid is an effectual remedy for bedbugs (page 1602).

COCKROACHES

Cockroaches are exceedingly annoying because of their proneness to get into substances and because of their filthy, disgusting habits. Often they become so numerous that they destroy considerable material. They are likely to attack the bindings of books and other leather articles. In the larder they will attack almost any foodstuff, polluting more than they actually destroy.

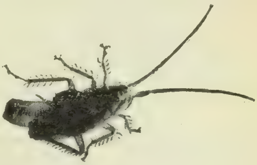

FIG. 11.—*Croton bug carrying egg capsule. Natural size*

Habits

Like the bedbug, the cockroach remains hidden during the day while the occupants of the building are actively about. When the kitchen and pantry are deserted and dark, however, the insect comes forth to forage. It prefers kitchens and pantries, where there is warmth and a supply of moisture.

The flat, thin bodies of roaches fit them admirably for crawling into cracks, behind baseboards, window casings, shelves, and other obstructions. The dark, sometimes almost black, color of these insects affords them protection on their nocturnal foraging expeditions. Roaches have the redeeming trait of being somewhat of an enemy to bedbugs; but the small benefit that they may confer in this direction will hardly compensate for their presence in dwellings.

The life history of a cockroach

There is yet much to be learned concerning the life history of the cockroach. Many guesses and astonishing statements have been made regarding the length of time that it takes young roaches to reach maturity. It has been said that four or five years are required for certain species to pass through the life cycle. In case of one or two species it is known that the life cycle is much shorter than this.

Cockroaches have the characteristic habit of depositing their eggs in compact masses, each mass being enclosed in a sort of capsule, or egg-case, instead of one at a time as most insects do. The capsule is more or less bean-shaped and, in some cases, contains just sixteen eggs borne in two rows. The capsule may be carried for a considerable period by the female before it finally becomes detached from her abdomen.

It is said that the croton bugs occupy three to five months in completing their growth. When the young first appear they are soft and whitish in color, but they soon harden and change to a darker color. They seem to molt at least six times before becoming adult.

Mr. Marlatt says that eggs of the common American roach hatched on July 11 and reached full growth between March 14 and June 12 of the following year, thus taking nearly a year to complete their growth. The rate of growth is slow and varies with the temperature and the food supply.

Kinds of domestic cockroaches

There are four principal species of roaches that frequent dwellings. These are the German cockroach, or croton bug; the American cockroach; the oriental roach, or "black beetle"; and the Australian roach.

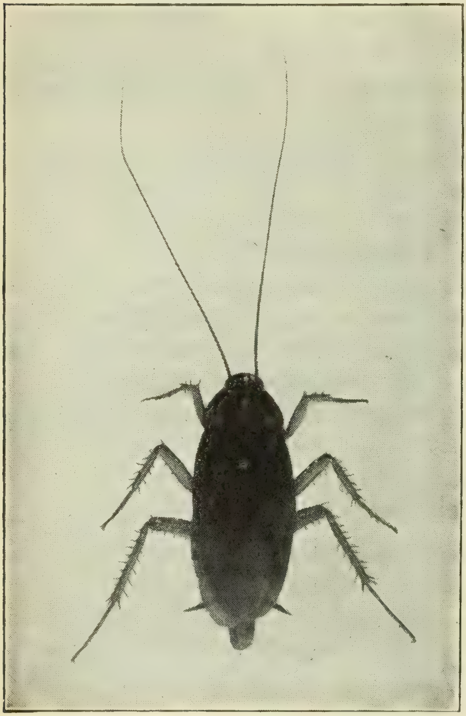

FIG. 12.— *The American cockroach*

The croton bug (*Ectobia germanica*) is the commonest species in the eastern and southern part of the United States. It is the smallest of the domestic species and the most difficult to control. It is light brown in color, with two characteristic dark brown lines on the thorax, and is about five eighths of an inch in length (Fig. 11). It has received the name "croton bug" because it first became prominent at the time when the Croton system of waterworks was installed in New York City. It accompanies the installation of water pipes in houses because the dampness attracts it and affords favorable conditions for its increase.

Next to the croton bug the American cockroach (*Periplaneta americana*) is perhaps the commonest and most widely distributed species in this country. It is the largest of the four species, and has long, well-developed wings (Fig. 12). This roach is supposed to have originated in tropical or semi-tropical America. It is a troublesome pest in feed mills in the Southern States and is most annoying on ships.

The third species is the oriental cockroach (*Periplaneta orientalis*), or " black beetle " as it is called in England (Fig. 13). It is a dark brown roach, becoming almost black in the older females. The males have two pairs of shortened wings, while the females are stouter and are wingless, or nearly so.

The last species (*Periplaneta australasiæ*) is fairly common in some of the Southern States. It resembles the American roach, although it is not so large. There is a bright, clearly defined yellow band on the thorax and a narrow yellow spot on each front wing.

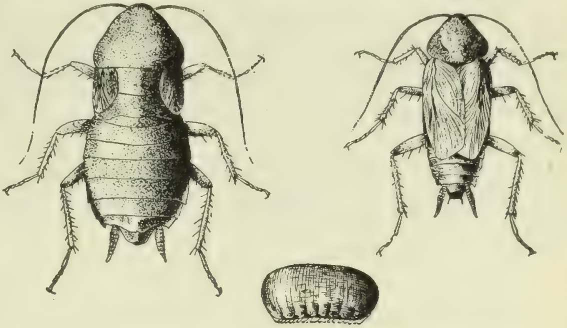

FIG. 13.— *Oriental cockroaches, male and female*

Methods of control

In fighting cockroaches, persistence should be the watchword. The insects are shy, apparently cautious regarding baits and poisons, and difficult to reach in any manner.

Various kinds of traps have been devised for catching roaches. The box with cone-shaped tubes in Fig. 14 affords a sample of a modern trap. The box is baited at night with cheese or other favorite food. The roaches can enter but cannot escape.

A rather unique method of killing roaches is described by Mr. Tepper of Australia. Plaster of paris, one part, is mixed in a saucer with flour, three or four parts, and placed where the insects are abundant. Near at hand is placed a flat dish containing water, with bridges so arranged that the roaches can easily reach it. They eat of the flour and the plaster of paris, and either are killed or leave the premises.

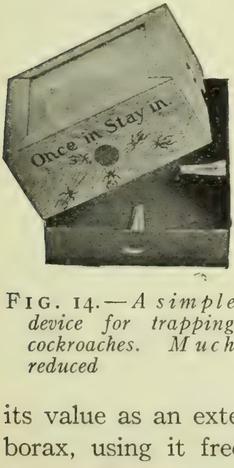

FIG. 14.—*A simple device for trapping cockroaches. Much reduced*

A powder known as insectoline, manufactured by the Insectoline Company, Chicago, Illinois, has given good results in fighting these insects. The writer has used it in kitchens and pantries with satisfactory results. In order to obtain the best results with this powder, it must be applied in large quantities and persistently.

Professor F. L. Washburn, after failure with several so-called remedies for cockroaches, tried powdered borax and has this to say concerning its value as an exterminator of roaches: "We then turned to powdered borax, using it freely in the kitchen with marked success. This was sprinkled in cracks about the sink, along the tops of baseboards, near the sink, and elsewhere, wherever there were cracks that afforded the insects a hiding place. By a generous use of this substance, persisted in for two weeks, the room, in fact, we may say the premises, were entirely freed from this disgusting pest."

Whatever powder or substance is used, it must be applied in large quantities and at short intervals for an extended period of time. Persistence and thoroughness are absolutely essential to the control of cockroaches.

Hydrocyanic acid gas is successfully employed against cockroaches. The method of using this gas is described in full on the last pages of this bulletin.

ANTS

Every one is more or less familiar with ants. They occur in all lands and in all regions, from the dry deserts to the damp forests.

Ants are known as social insects because they live in colonies, or communities, where every individual works for the good of the whole and not for itself alone. In a typical colony of ants there are at least three kinds of individuals: the queen, the males, and the workers. The queen is the mother of the colony and in no sense the ruler. Her only business seems to be to lay eggs, which hatch into workers and other forms that take the places of those that disappear or die, and thus she maintains the full and continuous strength of the community. The workers, which are undeveloped females, are wingless and constitute the great majority of the ants that may be seen running about in the vicinity of an ant nest. The workers do the work of the community: they build the nest, keep it clean, care for the queen and procure food for her and the larvæ, they care for the eggs, fight battles, and do many other things that contribute to the progress and comfort of the colony.

The life history of ants

Enough observations have now been made to enable us to say that most, if not all, colonies of ants are started by a solitary queen, or occasionally by two queens working together. After the swarming period, the queen alights, tears off her wings, digs a burrow in the soil or in decayed wood, forms a small chamber, and then closes the opening. Here she remains until her eggs are laid and have hatched into small larvæ, which finally mature into normal, but diminutive, workers. All this time the queen has taken no food, but has lived and fed her brood on the reserve material in her body. The small workers now begin to enlarge the nest, and soon larger workers are reared and the community begins to multiply and increase.

The eggs laid by the queen are small and white, and are rarely seen by the ordinary observer. They are solicitously cared for by workers and finally hatch into white, footless, soft, grub-like larvæ. The larvæ also are tenderly cared for by the workers and are carried from chamber to chamber in conformity with variation in temperature and moisture. The workers feed the larvæ, either on food which has been predigested and which the workers now regurgitate, or on bits of dead insects, leaves, or seeds that have been chewed fine. The larvæ, after attaining their growth, change to whitish pupæ. In some species the pupæ are inclosed in cocoons, while in other species they are not. The workers treat the pupæ with the same solicitude and care that they show toward the larvæ. The pupæ are often mistaken for eggs. Occasionally, on raising a flat stone one will see the workers running this way and that with the larvæ and the pupæ in their jaws, evidently seeking a place of safety for them. The pupæ finally transform to adult ants of the various forms—workers, queen, and males.

Household ants

In temperate regions there are several species of ants that may become annoying in dwelling houses. Perhaps the best-known species are the tiny red ant (*Monomorium pharaonis*), the small black ant (*Monomorium minutum*), the large carpenter ant (*Camponotus pennsylvanicus*), and the pavement ant (*Tetramorium cæspitum*). In some of the Gulf States the Argentine ant (*Iridomyrmex humilis*) has become the worst pest of them all.

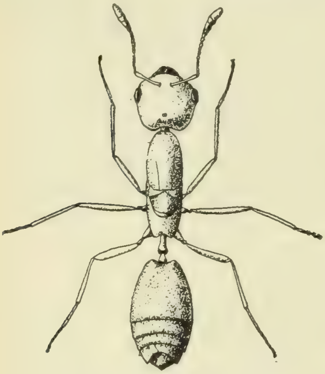

FIG. 15.— *The red ant*

The red ant.— This ant (Fig. 15), which is really light yellow in color, is only about one sixteenth of an inch long and, at times, literally swarms into houses. Because of its small size it crawls into everything that is not almost hermetically sealed. Scarcely any household products are distasteful to the red ants. They are especially fond of sugar, sirup, fruit juices, jellies, cakes, and fruit pies. Whenever one of the workers finds a pleasing morsel or supply of food, it immediately informs the rest of the community and they come quickly trooping to the source of supply. The discouraging part of the problem is that, no matter how many ants are killed, equal numbers seem to take the place of those destroyed. Such a condition is likely to exist as long as the queen is allowed to live and lay eggs undisturbed.

The small black ant.— The black ant is smaller, if anything, than the red ant, although there is little visible difference in size between the two. They differ noticeably in appearance, for the black ant is dark in color and is easily distinguished from the red one. The nests of black ants are sometimes under stones in the yard, but are more often in the open. The nests have small craters about the entrances, made of fine grains of soil. When the nests are opened there will usually be found, among the workers, one or more large females.

The black ant is not strictly a house ant, at least not so much so as the red ant; yet it often invades dwellings to a considerable extent and becomes a nuisance. The invasions are made by the workers, which wander some distance from their nests on foraging expeditions.

The large black carpenter ant. — The carpenter ant (Fig. 16) has the habit of leaving its natural haunts at times and often becomes an annoying pest in dwelling houses. This habit has evidently been assumed since the settlement of America and the erection of dwellings here. The natural haunts of the black carpenter ant are in decaying stumps, fence posts, logs, and other pieces of wood. They have been known to take up their abode in the decaying sill of a porch, from which vantage ground they became a nuisance in the kitchen. Moreover, they occasionally do serious damage to rafters and other timbers in buildings.

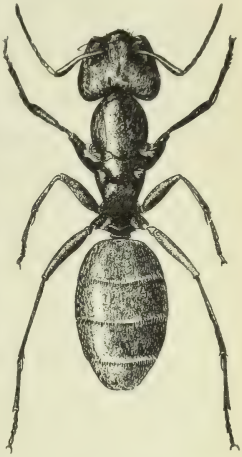
FIG. 16. — *The black carpenter ant*

The pavement ant.— The pavement ant is an introduced form. It seems to be widely distributed in Europe and constitutes one of the meadow ants in that country. When introduced into this country it took up its abode in some of our eastern cities along the Atlantic seaboard —New York, Philadelphia, and Baltimore. Here it established itself by building its nests beneath the pavement or under flagging stones in the yards of dwellings. From these situations of vantage and nearness to dwellings, the pavement ant has acquired the habit of entering houses and, in some instances, has become quite as much of a pest as the red ant.

Methods of control

Perhaps the first method of prevention is to remove the substance attracting the ants. If this cannot be done, the food may be placed on a support, the legs of which rest in water covered with a film of oil.

Another temporary expedient, and one that may discourage the ants enough to finally stop them from coming, is to soak small sponges in sweetened water and place them where the insects are most numerous. The ants will crawl into the pores of the sponges in great numbers and may be killed by dropping the sponges into boiling water. This process should be repeated over and over, and thousands of the workers may thus be destroyed. In instances in which this practice has been given a thorough and persistent trial, the ants have become so discouraged and bewildered by the sudden loss of so many workers that they have finally abandoned the house entirely.

A sirup made by dissolving sugar and borax in boiling water, placed about the infested room in small dishes, will attract and kill many of the ants. It is said also that camphor, either free or wrapped loosely in paper and placed around the foods attracting the ants, will drive them away.

If carefully watched, the ants may often be traced and the crack or opening through which they enter may be discovered. When found, kerosene oil should be squirted into it or it should be tightly plugged with cotton soaked in kerosene. This practice is often an effectual preventive.

Ordinary ants may be prevented from reaching tables by setting the legs of the tables in cups containing a little water with kerosene oil on the surface. This method avails little with the Argentine ants, however, since they soon manage to cross the oil on a causeway formed from the dead bodies of their sacrificed comrades. Against the red ant and the little black ant, the film of oil is an effective barrier until the oil evaporates, when it must be renewed.

Cyanid of potassium has been used with marked effect against ants in the field. It is a deadly poison and should be handled with great care. If it is powdered fine and scattered over an ant hill after the latter has been broken up or stirred on the surface, the ants will begin immediately to remove the pieces. In doing so, every ant that touches the cyanid will be killed. Colonies have been almost exterminated in this way, and whenever the colonies of the red ant can be located the cyanid may be used to advantage. It will be found more useful against the normally outdoor species, such as the pavement ant and the carpenter ant, than against the red ant.

It must be remembered that if fowls are allowed access to the poison and pick up the pieces they certainly will be poisoned. In order to obviate this difficulty, it is best to use the cyanid in solution by dissolving it in water at the rate of an ounce to a gallon of water. It may then be sprayed over the nest or poured down the openings. This method seems to be quite as effective as scattering the poison in the pulverized form; at least, experiments have shown that some species of ants may be nearly, if not quite, exterminated in this way. Another very effective method of application consists in placing a pint or more of the solution in hollows dug out at the exits of the burrows of the colony.

Ordinary cotton tape, treated with corrosive sublimate, acts as an effectual barrier to the red ant and other species. The tape is often wound about the legs of tables, or it may be tacked along the edges of shelves and in other places to protect food. The ants will not cross these strips of tape. The prepared tape may be bought in the larger cities of the South, but the author has never seen it for sale in cities in the North.

Since one often receives an inferior article from the store it is better to prepare the tape at home.

Mr. Newell makes a solution of the corrosive sublimate by heating it in water in a granite-ware vessel and dissolving all that the water will take up. After this solution has cooled it is filtered. The solution may be filtered, in the absence of filter paper, through a fine quality of cotton batting. A thick layer of the cotton should be placed in a funnel, and the solution should be poured in and allowed to filter through. The tape is then soaked in this filtered solution and pinned on the wall to dry. Neither the solution nor the tape should be allowed to come in contact with iron, tin, or steel. When the tape is well made it will remain effective for many months, even for a year.

Tartar emetic, mixed with four or five times its volume of sirup and placed about in shallow dishes, is an effective remedy against house ants. If some of this mixture, poured into individual butter plates, is set about in a refrigerator where ants are troublesome, or in a pantry that ants frequent, the little pests will soon leave. In some cases it has proved to be one of the simplest and most effectual remedies that can be used to rid a house of these persistent pests.

The only method of getting rid of ants permanently is by locating their nests and treating them in such a way that the queen will finally be destroyed. No more eggs will be laid, and the production of workers will cease. One of the best substances for treating nests, in order to kill the queen and exterminate the workers, is carbon bisulfid. It is often difficult to locate the nest, and sometimes when found it will be in an inaccessible situation; for example, it may be discovered in the foundation walls, under the floor, or in some other equally secluded and protected place. One writer suggests that black ants may be traced to their nests by baiting them with broken pieces of rice, farina, or cream of wheat. The ants will carry these pieces of white food to their nests and may be easily traced in this manner. Perhaps the red ant may be followed to its home by the same means. When the colony is located it may be treated with carbon bisulfid by pouring an ounce or two of the liquid into each of several holes made in the nest with a sharpened stick, after which operation the mouth of each hole should be quickly stopped with a clod of dirt. A heavy wet blanket thrown over the nest will aid in retaining the gas and will tend to make the fumigation more effective. The liquid evaporates quickly and the gas permeates the whole nest, killing the queen and the workers and exterminating the colony. By attaching a torch to the end of a long pole and extending it out over the nest while the operator stands at a safe distance, the gas may be exploded and the fumes driven into all corners of the colony. If the colony is located in the foundation walls, the problem will be much more difficult and may be impossible of solution. The difficulty will be in reaching the nest with the liquid. If the nest is located under the floor, it may be necessary to remove a piece of the flooring in order to gain access to the colony.

In the use of carbon bisulfid, it must be remembered that the gas is inflammable and explosive and no form of fire or light should be brought near the place that is being fumigated.

L. J. Nickels has been very successful in poisoning Argentine ants with a weak solution of sodium arsenite. For a weak solution, he dissolved a little more than one ounce of the arsenite in a small quantity of hot water. When dissolved the sodium arsenite was added to a sweetened solution of twenty pounds of sugar dissolved in three quarts of water. It was necessary to heat the sirup mixture so as to thoroughly dissolve the sugar.

In order to make a small amount of the mixture, three grams of the arsenite should be dissolved in a small quantity of water and added to a sweetened sirup of two pounds of sugar dissolved in three fourths of a pint of water. Small sponges may be soaked in this poisoned solution and placed in jars so that the ants can easily gain access to them. It seems that the ants will carry this slightly poisoned sirup to their nests and feed it to the queen and to the broods of young ants, gradually killing off the whole colony. It would seem as though the same mixture could be used effectively for common ants.

CLOTHES MOTHS

The clothes moths are all introduced species that came with our forefathers from European countries. It is certain that they have existed in this country for many years, for Peter Kalm, a Swedish scientist, in a quaint account of his travels in North America written in 1748, tells us that "Moths, or *Tineæ*, which eat the clothes, are likewise abundant here." Not only have these insects been long known and recognized in America, but they have been familiar to the human race for thousands of years. They are referred to in the Book of Job in the well-known passage, "And he, as a rotten thing, consumeth, as a garment, that is moth eaten."

There are three kinds of these moths in this country—the case-making clothes moth (*Tinea pellionella* Linn.), the webbing clothes moth (*Tineola biselliella* Hum.), and the gallery-making moth (*Trichophaga tapetzella* Linn.).

The case-making clothes moth

There seems to be a difference of opinion as to whether this or the webbing moth is the more common species in the northern part of this country. Doctor Fletcher finds that the latter is more common in Canada, while Dr. C. V. Riley believes that the former is more common in the northern United States.

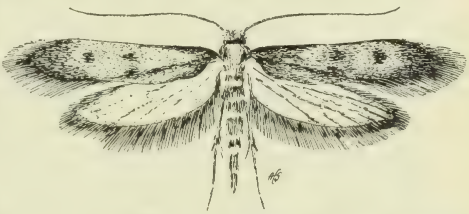

Fig. 17.— *The case-making clothes moth. Enlarged*

The moths of the case-making species are small, measuring only about half an inch from tip to tip of the tiny wings when they are fully expanded (Fig. 17). The fore wings are of a shining yellowish brown color, with three distinct dark spots on them.

Normally the moths appear in the spring and may be seen flitting about rooms most of the summer. They are apparently more or less attracted by lights and are frequently seen flying aimlessly about a lamp at night. The moths, of course, are innocent enough, but they deposit eggs which hatch into the tiny white larvæ that eat clothing. The eggs are tucked away among the folds of the garments. When the eggs hatch, the small larvæ immediately begin to make cases for themselves. The case is nearly cylindrical and is made of silk and fragments of the material on which the larva feeds. As the larva grows it enlarges its case from time to time, but never leaves its tiny house. The larvæ are voracious and soon eat holes in the garments on which they are feeding. It is said that the larvæ pass the winter in their cases and transform to moths in the spring.

The webbing clothes moth

This moth varies considerably in size (Fig. 18). It is yellowish in color, being generally described as having "shining ocherous fore wings" without spots or markings. Doctor Fletcher found it common in southern Canada, and Washburn finds it apparently common in Minnesota. We have found it the most abundant clothes moth about Ithaca, New York.

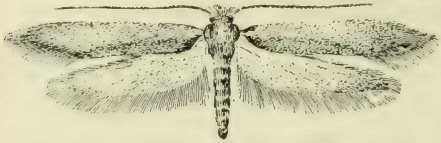

Fig. 18.— *The webbing clothes moth. Enlarged*

The larvæ live on a great variety of materials, but are especially fond of fur, feathers, wool, and bodies of dead insects, and are occasionally found in the upholstering of furniture.

The larva of this moth does not build a case in which to live, and has been called the naked clothes moth. When the larva is full grown, however, it builds a cocoon of silk, intermixed with bits of food material.

The gallery-making clothes moth

The gallery-making clothes moth, also known as the tapestry moth (Fig. 19), is somewhat rare in this country but apparently is common in England. It is considerably larger than either of the other two moths. The outer half of the front wings is white, clouded with gray, and the head bears a tuft of long, white hairs.

The larvæ feed on a variety of materials, such as pelts, felts, carpets, horse blankets, upholstering of carriages, and similar substances. The larvæ are often more frequently met with in outhouses where carriages are kept than in dwellings; at least this is true in England. They burrow inside of the material on which they feed when it is thick enough to enable them to do so.

Methods of control

First of all, it should be definitely understood that odors emanating from small quantities of various substances, such as camphor balls, cedar, and naphthalene, have no killing effect either on moths or on larvæ. Cedar chests or closets lined with cedar are of no avail if eggs are once deposited on clothes stored in them. Apparently, the odor of cedar has some repelling effect on the moths themselves. The odor of camphor balls also has a

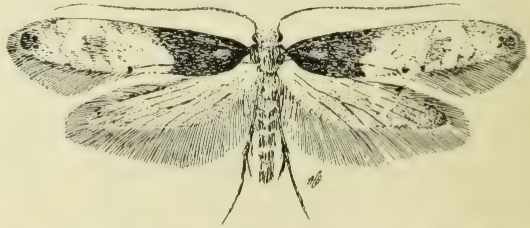

Fig. 19.— *The gallery-making clothes moth. Enlarged*

repellent effect on the moths; but a few moth balls placed among clothes in a chest do not prevent injury if eggs are deposited on the garments before the latter are put away. The real function and value, then, of cedar chests or closets lies in repelling moths and keeping them away from the garments. The clothing, however, must be free from all eggs and larvæ of the moths before being put in chests. Great care must be taken to shake and brush the garments and to have them in the sun and air until all the larvæ and eggs have been shaken loose and destroyed.

In the second place, it should be understood that garments which are often worn are not liable to injury. It is the clothing and the materials that are stored away in closets and trunks for a long time undisturbed, which are badly injured. It is under such conditions that the moths have an opportunity to deposit their eggs, that the eggs have a chance to lie undisturbed long enough to hatch, and that the larvæ have occasion to eat and to grow to maturity.

Sunlight and air are among our best available agents of protection from clothes moths. Before garments are put away for the summer, they should be hung in the air and sun, and then be thoroughly brushed and shaken so as to dislodge the eggs and larvæ that may be on them. In addition, they should be taken out occasionally, perhaps once a month, and brushed, shaken, and aired. The same treatment should be accorded woolen bedding and blankets that are to be stored. After the clothes are once thoroughly cleaned, sunned, and aired, they may be packed away with a supply of camphor balls distributed among them to repel the moths. It is advisable to spray the cracks in closets and chests with benzine or gasoline before putting the clothes in them, in order to kill any eggs or larvæ of the moths that may be lurking there.

A few old woolen rags or pieces of old furs, stored in attics but never used, are prolific breeding-places for these moths and should be taken out and burned.

Doctor Howard early suggested a method of storing winter wraps and garments during the summer, which is practical and efficient. He goes to the tailor shop and buys a few common pasteboard suit-boxes, and in these the garments to be stored are neatly folded away. Then the cracks around the edges of the cover are sealed by pasting strips of paper over them. This makes a tight box that excludes all moths. With care the boxes last several years.

Another method of storing clothes is given by a resident of the city of Washington, D. C. He has a wooden chest for holding his clothes. In the cover of the chest he has bored a large hole and on the underside of the cover, directly beneath the hole, he has tied a large sponge. In the middle of the summer he pours a little carbon bisulfid on the sponge and closes the hole with a cork.

Cold-storage plants are common nowadays in all cities and in many small towns. During the summer these plants are available for the storage of furs, rugs, and other valuable woolen goods.

Doctor Howard reports some experiments which demonstrate that a continuous temperature of forty degrees is sufficient to maintain the larvæ of clothes moths in an inactive condition and thus prevent injury by them. In the light of these experiments, cold storage forms the simplest and safest method of protecting woolen goods from the ravages of clothes moths.

FLEAS

About fifty species of fleas have been recorded from this country. They are found on many different mammals and birds, and at least two species are annoying to man.

The body of a flea is compressed from left to right, thus fitting it for crawling among the hairs of its host. Moreover, many fleas have strong, spine-like hairs projecting backward from the posterior edges of the body segments. Undoubtedly these projecting spines catch around the bases of the hairs and serve to prevent the insect from slipping backward. Fleas are wholly wingless, but their legs are long and fitted for jumping.

The mouth of a flea is constructed for piercing the flesh and sucking the blood.

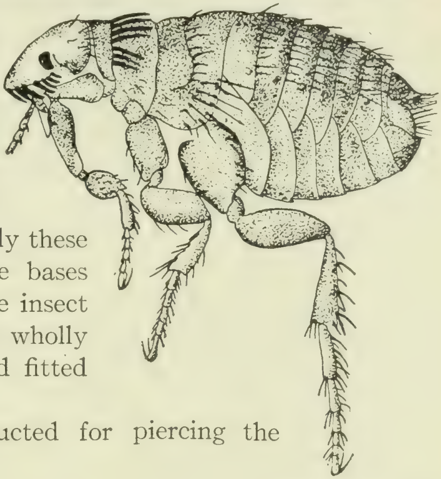

FIG. 20. — *Cat or dog flea. Much enlarged*

Fleas commonly found in houses

There are two species of fleas that frequent dwelling houses in the United States. These are the human flea (*Pulex irritans*) and the cat and dog flea (*Ctenocephalus canis*). Most of the fleas that we have found infesting houses in the East and South are of the latter species (Fig. 20). The writer has seen houses literally overrun with the cat and dog flea. In one instance a house had been closed for three or four weeks in the absence of the mistress, but in the meantime had remained accessible to the pet cat. The fleas had become so abundant that one could not remain in the lower rooms with any degree of comfort.

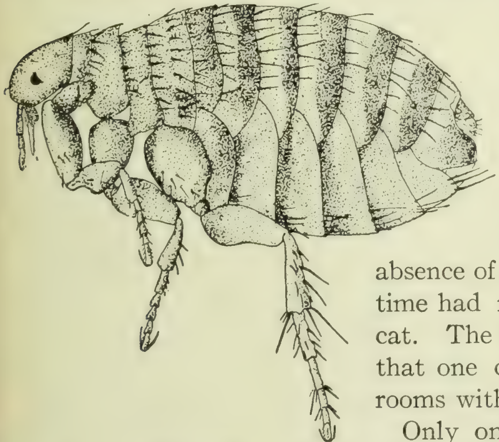

FIG. 21. — *Human flea. Much enlarged*

Only once have we had complaints of fleas when the species causing the trouble proved to be the true human flea (Fig. 21). In California, however, the human flea seems to be the commonest species found in the abodes of man. Doane gives a list of 916 fleas taken from human hosts and from houses in San Francisco, of which 913 were human fleas and 3 were the common rat flea (*Ceratophyllus fasciatus*).

The life history of fleas

Like the house fly and the mosquito, there are four distinct stages in the life history of a flea, namely, egg, larva, pupa, and adult.

A flea does not pass its whole life cycle on the host that it infests. Only the mature stage, or adult, is found on the infested animal, the other stages being spent in entirely different situations.

The eggs of the dog and cat flea are deposited, as a rule, while the insect is on the body of the host. It is probable that in many instances the eggs are deposited on floors, carpets, or cloths on which the dog or cat may be lying. If laid while the parent flea is on the host, they are not attached to the hairs and do not remain on the body of the dog or cat but fall to the floor. There are usually numbers of eggs around the spot where a flea-infested dog or cat has been lying. The eggs are white and waxy, plainly visible to the eye, and oval in shape; and it would take about forty of them placed end to end to reach an inch.

The eggs soon hatch into small, white, worm-like larvæ. These are active, wriggling creatures, and they crawl away into cracks and crevices where they feed on whatever organic matter can be found. Under favorable conditions they attain their growth in ten days or two weeks, and then spin a fine silken cocoon, often covered with dust, inside of which they change to pupæ. In a week or ten days the adult fleas appear. Under the most favorable conditions a flea may pass through its life cycle in about two weeks.

The relation of fleas to disease

Fleas are now known to be active and menacing agents in the conveyance of disease, especially the bubonic plague. The many investigations that have been made of the relation of fleas to the bubonic plague by different plague commissions and by private individuals point to the definite conclusion that rats and fleas are at least the most important factors in the spread of the disease. The bubonic plague is probably primarily a disease of rats and only secondarily a human disease. Epidemics of the plague seem to be usually preceded by this disease among the rats of the locality affected. San Francisco, in her late fight with the plague, gave much attention to the control of rats, basing her method of work on the foregoing ideas of the relation of rats to the disease and the relation of fleas to man. The results of the fight were eminently successful and certainly serve to strengthen the soundness of the theory.

Fleas have also been suspected of bearing some relation to the dread disease of leprosy. The bacilli of leprosy have been found in the intestines of certain fleas, and it seems altogether possible that the insects might carry the bacillus to a human host. However, no definite proof has been obtained showing that fleas actually disseminate the disease.

Methods of control

It follows from what has been said regarding the kinds of fleas found in houses, and their rate of increase, that pet dogs and cats must be eliminated or must be kept clean and free from these pests. These animals may be kept reasonably free from fleas by frequently bathing them in a solution of creolin. A dog can be bathed with a three-per-cent solution, four teaspoonfuls to a quart of water, or four tablespoonfuls to a gallon of water. Cats are more sensitive and should be bathed with a two-per-cent solution.

A dog or a cat should be provided with a sleeping-cloth, or rug, which should be beaten and shaken at least once a week and hung in the sunlight, if possible, for a few hours. If infested, the kennel should be thoroughly washed inside and outside with a five-per-cent solution of creolin.

To clear a house of fleas when it is once infested is often a strenuous task. In the first place, a change from carpets to rugs, if possible, is recommended. The larvæ of fleas cannot develop in rooms in which the floors are exposed and swept from time to time. In severe infestations, nothing but the removal of all floor coverings, followed by a thorough washing of the floors with strong soapsuds, will avail. In case of old floors, the cracks should be filled with some good filler.

The use of benzine or gasoline will also be very helpful. The carpets should be sprinkled with the gasoline. Special attention should be paid to the edges of the carpets and to the cracks underneath the baseboards. Great care should be exercised regarding fire while gasoline is being applied, owing to its inflammable character.

Miss Fields, long a resident of southern China, says she renders her house immune to fleas by dissolving alum in the whitewash or the calcimine when it is applied to the walls. She also places sheets of thick paper, dipped in a solution of alum, under the matting and scatters pulverized alum in all crevices where the insects might breed. Powdered alum, she states, may be scattered on the carpet and swept into its meshes without injury. Dr. Henry Skinner has had good results with the use of flake naphthalene. He said that he "took one room at a time, scattered on the floor five pounds of flake naphthalene and closed it for twenty-four hours. On entering such a room the naphthalene vapor will instantly bring tears to the eyes and cause coughing and irritation of the air passages. . . . . It proved to be a perfect remedy and very inexpensive as the naphthalene could be swept up and transferred to other rooms."

CARPET BEETLES

There are two species of beetles in the United States that have come to be known as carpet beetles. Both are small insects, not familiar to most housekeepers. The larvæ, or grubs, of these beetles really do the mischief, and with these many housekeepers are only too well acquainted. The larva of one of these carpet beetles has come to be known as the "buffalo bug," or the "buffalo moth," and it is the commoner and the better known of the two. The other species is known simply as the black carpet beetle.

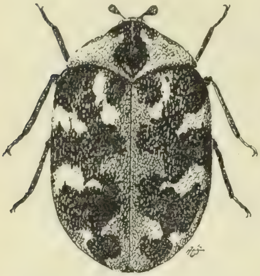

FIG. 22. — *The "buffalo moth" carpet beetle.*

The "buffalo bug," or "buffalo moth"

(*Anthrenus scrophulariæ* L.)

The names "buffalo bug" and "buffalo moth" are misnomers, because the insect is neither a bug nor a moth. On the contrary it is a small beetle (Fig. 22) about three sixteenths of an inch in length, with a general background of black, spotted and speckled with white, and with a red line down the middle of its back. Near each end of the red line and at its middle there are side projections of red. Thus the beetle is rather handsome in its markings of black, red, and white. The beetle has evidently come to us from Europe, but in its native country it does not seem to be a serious household pest.

The curiously wrinkled, whitish eggs are laid by the mother beetle among the fibers of the cloth on which the larvæ will feed. Here, under favorable circumstances, the eggs hatch in two or three weeks and the larvæ eat voraciously, grow rather rapidly if food is available, and cast their skins, under normal conditions, about six times.

The larva is about one quarter of an inch in length and is covered with long brown hairs. After the larva reaches full growth it transforms, within its last skin, into the pupa. Finally this old larval skin splits down the back, disclosing the pupa within. Eventually the pupa transforms to the adult beetle, which often finds its way to window-panes in search of an exit to its outdoor food plants. In this latitude there is one generation, possibly two, each year.

The larvæ, when abundant, may injure carpets rather seriously. They gnaw holes in the borders of the carpets where the latter are nailed to the floor. Sometimes the larvæ follow a crack in the floor and cut a slit in the carpet almost as neatly as though it were cut with the scissors. They not only are injurious to carpets, but attack woolen goods as well, or even wearing apparel in closets, drawers, and trunks.

The black carpet beetle

(*Attagenus piceus* Oliv.)

In the case of this insect we have a pest with a varied menu. It has a liking for specimens in the museum and for cereal products. Moreover, it is a frequent pest in feathers, sometimes causing what is known as "felting" in pillows. Its main claim to notoriety, however, is as a pest to carpets. It has apparently become more numerous in some houses than the "buffalo moth."

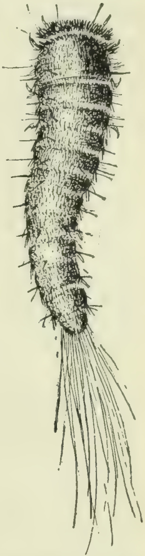

FIG. 23.—*Larva of the black carpet beetle*

As in the case of the "buffalo moth," it is not the adults that commit the injury but the larvæ. The larva is long and slender, and tapers toward the posterior end. It is reddish brown in color, rather active, and clothed with hairs; the posterior end of the body terminates in a pencil of long hairs (Fig. 23). It is easily distinguishable from the "buffalo moth" and the illustrations should enable any one to tell the two apart.

The adult is a small blackish beetle about one sixteenth of an inch in length (Fig. 24). It is almost twice as long as it is wide, and rather flattened. It is sober in coloring and can readily be distinguished from the more gayly colored "buffalo moth" beetle.

The life history of this insect is not well known. Its eggs are white and of a broad oval shape, and are probably deposited about the edges of the carpets or on the woolens or other materials on which it may be feeding. Doctor Chittenden has met with the larvæ in seeds and other vegetable matter and has shown that they will breed successfully from the egg in flour and meal. In his studies of the life history of this pest he found that two years were required for its development from egg to beetle. The pupal stage was shown to last six to fifteen days.

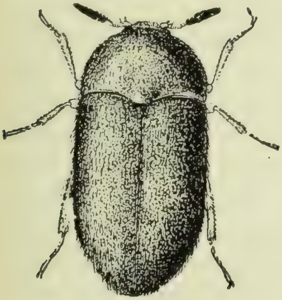

FIG. 24.— *Black carpet beetle*

We have had the adults appearing in May in our breeding jars and in dwellings. The pupæ are clothed with a coat of whitish hairs, among which débris becomes entangled; the whole resembles a very thin, delicate cocoon. On the dorsal side of each of six segments of the abdomen there is a brownish eye-like spot. The inner edges of the spots are fringed with minute teeth. When the pupa is stroked with a needle along the back, these spots contract and close up. The larvæ of the black carpet beetle are certainly active throughout the winter in well-heated houses.

Methods of control

The carpet beetles, will always be difficult to control in houses having floors completely covered with carpets that are tightly tacked about the edges. A carpet placed permanently on the floor and allowed to remain there undisturbed for a year furnishes ideal conditions for these pests to thrive and increase. As was urged in the case of fleas, so again it is urged that a change from carpets to rugs be made if possible. Where bare floors, partially covered with rugs, are maintained, the carpet beetles will not find hiding-places suited to their development. Moreover, the rugs can be examined without difficulty at any time and they are usually dusted and aired too often for the larvæ to gain a foothold. The tendency among modern homes is to use rugs on polished floors, with a consequent diminution of the carpet beetles as a household pest.

Where the insects have become well established in a house, nothing but heroic measures and long-continued efforts will avail. House-cleaning should certainly occur twice a year instead of once and should be very thoroughly done, at least so far as the carpets are concerned. They should be removed, thoroughly dusted and beaten, sprayed with gasoline, and hung in the air and sunlight as long as possible.

The floors should be thoroughly washed and scrubbed with soap and water, especially along the baseboards and the cracks of the floors. It would be of advantage to spray the cracks beneath the baseboards with benzine or gasoline, to clean out all the dirt possible from the cracks in the floor, and to pour in benzine or kerosene oil. Before the carpet is replaced on old floors, the cracks should be filled with a crack-filler and thus the favorite hiding-places for the larvæ might be eliminated. In badly infested houses, tarred building-paper may be placed beneath the carpets, but the odor from such paper is not always pleasant.

The carpet may be loosely tacked about the edges, thus affording the owner an opportunity to examine it so as to see whether the pests have returned. The following is a good account of the manner in which one housekeeper finally got rid of these pests: " My own experience with them began last year. We moved to our present abode in April, and it was not until every carpet had been put down and the house settled that I was aware that we had such unwelcome guests. I was not long in observing their habit of running into any crack and crevice that presented itself, and also running along the joints of the floors, and our warfare against them was directed toward these joints. In the closets we stopped up every nook on the walls; every crevice under the baseboards, and filled up the joints of the floors; then we laid down oilcloth, and kept a plentiful supply of camphor in the closets. I am happy to say that we have had no trouble with them since so doing.

"Fortunately, we had put paper under all the carpets, so we felt that they were in a measure, at least, protected, but I found them continually, just under the edges of the carpet. As far as possible, we filled up the crevices under the baseboards and I used benzine plentifully all the summer, saturating the borders of the carpets every two weeks and killing all I saw in the meantime. Last spring we varnished the cracks of the floors, and in some cases, where they were open, covered them with strips of thin muslin stuck down with the varnish; we again put paper under the carpets, as we had found it such protection the previous year. I have found the various insect powders of no use whatever when the insect is in the larval state: whether or not it has any effect on the beetle I cannot say; but this I can state,—that our unceasing warfare has not been in vain, for I have, during the past summer, seen only single ones where last year I found scores."

Hydrocyanic acid gas.— This gas is quite as effectual for the carpet beetle as it is for the bedbug (page 44).

Sulfur.— The fumes of sulfur are quite as effective as hydrocyanic acid gas if enough of the sulfur is burned at one time. Not less than two pounds of sulfur to a thousand cubic feet of space should be used. The room should be tightly calked and closed as described in the chapter on bedbugs (page 18). We would again call attention to the injury that may result from sulfur fumes to metals, wall paper, and similar furnishings.

Corrosive sublimate and alcohol.— As we have pointed out, the larvæ congregate mostly about the edges of the carpets. It is said that a solution of sixty grains of corrosive sublimate, dissolved in a pint of alcohol and applied to the edges and undersides of the carpet around the borders, will poison the larvæ when they begin to eat the fabric. The alcohol quickly evaporates and leaves the corrosive sublimate among the fibers of the carpet, where it will remain for a long time. Since corrosive sublimate is such a virulent poison, great care must be exercised when children are likely to play about the room lest they get hold of some of the material and become poisoned.

Trapping the larvæ.— The larvæ may be trapped by placing woolen cloths, especially red ones, in closets. Among these the larvæ will congregate and may be caught and killed by shaking the cloths once a week over a piece of paper. If persistent effort is made, many of them may be killed.

Protection of furs and woolens.— These may be stored in boxes in exactly the same manner as is described in the chapter on clothes moths. The box arranged for the application of carbon bisulfid serves as well in protecting materials from the carpet beetle as from the clothes moths.

THE LARDER BEETLE

(*Dermestes lardarius* Linn.)

Ham, bacon, and other kinds of meat that happen to be stored in the larder, are sometimes attacked by small, brown, hairy larvæ, about one half inch long when fully grown, which often cause considerable injury and become the source of much worry to the housekeeper. The larva may be recognized by its hairy body and by the two short, curved, stiff spines on the top of the last abdominal segment (Fig. 25).

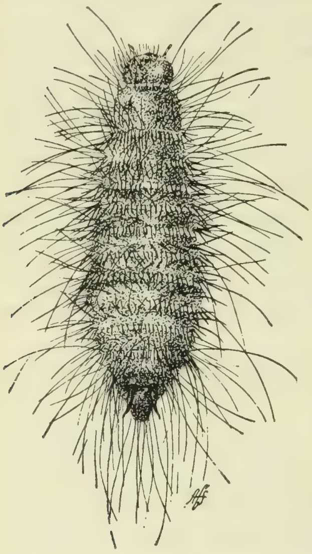

FIG. 25.—*Larva of the larder beetle*

The adult is a small beetle, one fourth to one third of an inch in length and dark brown in color (Fig. 26). It has a pale yellowish brown band across the anterior half of its wing covers. On this band there are six black dots, three on each side of the middle line.

The beetles enter the house in May and in June and seek for food on which to deposit their eggs. If no food can be found, the beetles deposit the eggs in cracks and crevices about the pantry where the larvæ can find food.

The larvæ usually confine themselves to the outside parts of the ham at first. Later, as they grow, they burrow farther into the meat. They seem to prefer the fatty parts more than the lean parts. It has been observed that the larvæ tend to infest hams that are beginning to spoil, rather than fresh ones.

From the meager accounts that we have of the life history of this insect, it seems that under favorable conditions there may be several generations in a year. Evidence has been obtained to show that a generation may be produced in forty-five to fifty days.

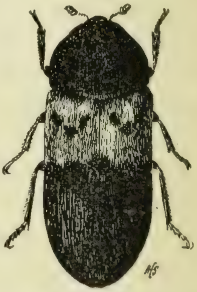

FIG. 26.—*The larder beetle*

Methods of control

In the first place, the beetles are easily seen and may be caught by hand and killed. This may be the most satisfactory way of dealing with them if they are not too abundant.

Cheese is very attractive to the beetles; if pieces are exposed here and there the beetles will congregate and may be caught and killed in considerable numbers. Cheese ground up and poisoned with arsenic, and then placed in the haunts of the beetles, will often kill many of them.

When hams and shoulders are put away they should be bagged as early as possible after being cured and should be wrapped with great care. If the least crack or opening is left the larvæ will find entrance.

If a ham or similar food should become infested with the grubs, the part containing them should be cut away and burned; the remaining part of the meat should be treated with a dilute solution of carbolic acid.

If the beetles become abundant and there are many hiding-places, the room in which they are present should be entirely cleared of food products and anything else that may interfere with the work of cleaning. The storeroom should then be thoroughly cleaned and finally sprayed with benzine or fumigated with carbon bisulfid.

FISH MOTHS

(*Lepisma saccharina*)

In taking from a shelf a book that has remained undisturbed for some time, we often catch a glimpse of a glistening, silver-gray insect that glides quickly out of sight. It is not a moth, nor is it closely related to a moth, nor does it remotely resemble a moth in general appearance or habits. Its body is clothed with shining scales like that of a fish, and it is variously known as silverfish, silver witch, sugar louse, sugar fish, and bristletail. It is still a question whether this insect lives on vegetable or animal products, or, when hard pressed, on both. It is commonly said that the fish moth lives on vegetable matter, mainly on starch and sugar. In proof of this the injuries to laundered clothes, bindings of books, wall paper, and similar materials are cited. These insects have been known to injure starched curtains hanging at the windows. On the other hand, one observer says that the fish moths feed on animal matter, such as glue and the bodies of their own dead comrades. The truth probably is that they live on any of the substances mentioned, taking what opportunity offers.

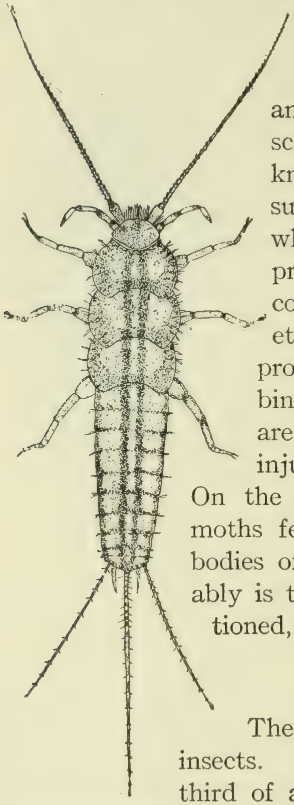

FIG. 27.—*A fish moth. Enlarged*

Description of the insect

The fish moth is a member of the lowest group of insects. It has no wings and its body is about one third of an inch in length, tapering gradually from the head to the posterior extremity; and it is covered with minute silvery scales. Because of the covering of scales it is almost impossible to catch a specimen without crushing or greatly damaging it. Like other insects it has six legs, which, although they are not abnormally long, are nevertheless powerful and enable it to run very swiftly for so small an animal. At the posterior end of the body are three long, slender, bristle-shaped projections, the middle one extending straight backward and the other two extending to the right and the left at considerable angles to the body (Fig. 27).

Methods of control

Usually books stored in moist basements or other damp rooms are the most seriously injured. This, of course, suggests airy, dry rooms for the storage of books or valuable papers if one wishes to preserve them free from injury by the fish moth.

Another common method of preventing injury to books and papers is by the frequent use of buhach powder. Fresh buhach should be sprinkled freely on the shelves and on the books themselves. Moreover, this treatment should be given frequently where these pests are abundant and persistent, because the powder so soon loses its strength. In badly infested houses, starched clothes, stiffened silk, and similar fabrics should not be allowed to remain too long packed away in drawers or loose in chests or boxes.

It is customary for librarians to poison sweetened paste with white arsenic, spread the mixture on pieces of cardboard, and slip the latter about on shelves among the infested books as bait for the fish moths. It would seem that a like method of procedure, in which glue is substituted for the starch matter, might also succeed in killing the pests. These pieces of cardboard might be placed about among garments or other stored fabrics if injury by the fish moth is anticipated.

HYDROCYANIC ACID GAS AGAINST HOUSEHOLD INSECTS

Hydrocyanic acid gas has been used successfully against household insects and will probably be used more and more in the future. It is particularly effective against bedbugs and cockroaches, but because *it is such a deadly poison it must be used very carefully.*

The gas is generated from the salt potassium cyanid, by treating it with sulfuric acid diluted with water. Potassium cyanid is a most poisonous substance and the gas emanating from it is also deadly to most, if not all, forms of animal life. The greatest care must always be exercised in fumigating houses or rooms in buildings that are occupied. Before fumigation a house should be vacated. It is not necessary to remove furniture or belongings except brass or nickel objects, which may be somewhat tarnished, and butter, milk, and other larder supplies that are likely to absorb gas. If the nickel and brass fixtures or objects are carefully covered with blankets they will usually be sufficiently protected.

There may be danger in fumigating one house in a solid row of houses if there is a crack in the walls through which the gas may find its way. It also follows that the fumigation of one room in a house may endanger the occupants of an adjoining room if the walls between the two rooms are not perfectly tight. It is necessary to keep all these points in mind and to do the work deliberately and thoughtfully. The writer has fumigated a large college dormitory of 253 rooms, once a year for several years, without the slightest accident of any kind. In order to fumigate this building about 340 pounds of cyanid and the same amount of sulfuric acid were used each time. In addition to this. the writer has fumigated single rooms and smaller houses with the gas. In one instance the generating jars were too small; the liquid boiled over and injured the floors and the rugs. Such an accident should be avoided by the use of large jars and by placing old rugs or a quantity of newspapers beneath the jars.

The proportions of ingredients

Experiments and experience have shown that the potassium cyanid should be ninety-eight per cent pure in order to give satisfactory results. The purchaser should insist on the cyanid being of at least that purity, and it should be procurable at not more than forty cents per pound. The crude form of sulfuric acid may be used. It is a thickish, brown liquid and should cost not more than four or five cents a pound. If a room is made tight, one ounce of cyanid for every one hundred cubic feet of space has been shown to be sufficient. It is combined with the acid and water in the following proportions:

Potassium cyanid	1 ounce
Commercial sulfuric acid	1 fluid ounce
Water	3 fluid ounces

A single room as an example

Suppose a room to be 12 by 15 by 8 feet. It will contain 12 x 15 x 8, or 1440, cubic feet. For convenience the writer always works on the basis of complete hundreds; in this case he would work on the basis of 1500 cubic feet, and thus be sure to have enough. The foregoing room, then, would require 15 ounces of cyanid, 15 ounces of sulfuric acid, and 45 ounces of water. The room should be made as tight as possible by stopping all the larger openings, such as fireplaces and chimney flues, with old rags or blankets. Cracks about windows or in other places should be sealed with narrow strips of newspaper well soaked in water. Strips of newspaper two or three inches wide that have been thoroughly soaked in water may be applied quickly and effectively over the cracks around the window sash and elsewhere. Such strips will stick closely for several hours and may be easily removed at the conclusion of the work.

While the room is being made tight, the ingredients should be measured according to the formula already given. The water should be measured and *poured first* into a stone jar for holding at least two gallons. The jar should be placed in the middle of the room, with an old rug or several newspapers under it in order to protect the floor.

The required amount of sulfuric acid should then be poured rather slowly into the water. *This process must never be reversed*; that is, *the acid must never be poured into the jar first.* The cyanid should be weighed and put into a paper bag beside the jar. All hats, coats, or other articles that will be needed before the work is over should be removed from the room. When everything is ready the operator should drop the bag of cyanid gently into the jar, holding his breath, and should walk quickly out of the room. The steam-like gas does not arise immediately under these conditions, and ample time is given for the operator to walk out and shut the door. If preferred, however, the paper bag may be suspended by a string passing through a screw eye in the ceiling and then through the keyhole of the door. In this case the bag may be lowered from the outside after the operator has left the room and closed the door.

The writer has most often started the fumigation toward evening and left it going all night, opening the rooms in the morning. The work can be done, however, at any time during the day and should extend over a period of five or six hours at least. It is said that better results will be obtained in a temperature of 70° F., or above, than at a lower degree.

At the close of the operation the windows and doors may be opened from the outside. In the course of two or three hours the gas should be dissipated enough to allow a person to enter the room without danger. The odor of the gas is like that of peach kernels and is easily recognized. The room should not be occupied until the odor has disappeared.

Fumigating a large house

The fumigation of a large house is merely a repetition, in each room and hall, of the operations already described for a single room. All the rooms should be made tight, and the proper quantities of water and sulfuric acid should be measured and poured into jars placed in each room with the cyanid in bags beside the jars. When all is ready, the operator should *go to the top floor and work downward* because the gas is lighter than air and tends to rise.

Precautions

The cyanid should be broken up into small pieces not larger than small eggs. This can best be done on a cement or brick pavement. It would be advantageous to wear gloves in order to protect the hands, although the writer has broken many pounds of cyanid without any protection on the hands. Wash the hands thoroughly at frequent intervals in order to remove the cyanid.

The operations of the work must be carried out according to directions.

The work should be done by a calm, thoughtful, and careful person — best by one who has had some experience.

Conspicuous notices of what has been done should be placed on the doors, and the doors should be locked so that no one can stray into the rooms.

The gas is lighter than air, therefore one should always begin in the rooms at the top of the house and work down.

After the fumigation is over the contents of jars should be emptied into the sewer or some other safe place. The jars should be washed thoroughly before they are used again.

It must be remembered that cyanid is a deadly poison; but it is very efficient against household insects, if carefully used, and is not particularly dangerous when properly handled.

BOOKS AND PAMPHLETS THAT MAY BE CONSULTED FOR FURTHER INFORMATION ON HOUSEHOLD INSECTS

Our household insects. By E. A. Butler. Longmans, Green & Co., 1896. (An English work.)

The house fly, disease carrier. By L. O. Howard. Frederick A. Stokes Company, 1911.

Mosquitoes, how they live, carry disease, etc. By L. O. Howard. McClure, Phillips & Co., 1901.

Insects and disease. By R. W. Doane. Henry Holt & Co., 1910.

The principal household insects of the United States. United States Department of Agriculture, Bureau of Entomology, Bulletin No. 4, n. s.

Mosquitoes or Culicidæ of New York State. By Dr. E. P. Felt, State Entomologist. New York State Museum, 1904, Bulletin 79.

Report on mosquitoes. By J. B. Smith. Report of New Jersey Agricultural Experiment Station, 1905.

Mosquitoes and fleas. United States Department of Agriculture, Bureau of Entomology, Circular No. 13.

Notes on the mosquitoes of the United States. United States Department of Agriculture, Bureau of Entomology, 1900, Bulletin No. 25, n. s.

How to distinguish the different mosquitoes of North America. United States Department of Agriculture, Bureau of Entomology, Circular No. 40.

How insects affect health in rural districts. United States Department of Agriculture, Farmers' Bulletin No. 155.

House flies. United States Department of Agriculture, Bureau of Entomology, Circular No. 35.

House ants. United States Department of Agriculture, Bureau of Entomology, Circular No. 34.

The true clothes moths. United States Department of Agriculture, Bureau of Entomology, Circular No. 36.

The carpet beetle or "buffalo moth." United States Department of Agriculture, Bureau of Entomology, Circular No. 5.

The bedbug. United States Department of Agriculture, Bureau of Entomology, Circular No. 47.

Cockroaches. United States Department of Agriculture, Bureau of Entomology, Circular No. 51.

The silver fish. United States Department of Agriculture, Bureau of Entomology, Circular No. 49.

House fleas. United States Department of Agriculture, Bureau of Entomology, Circular No. 108.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

ENTERED AS SECOND-CLASS MATTER AT THE POST OFFICE AT ITHACA, NEW YORK

W. A. STOCKING, JR., *Acting Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III, No. 49 OCTOBER 1, 1913 SANITATION SERIES No. 3

HOUSEHOLD INSECTS AND METHODS OF CONTROL

DISCUSSION PAPER

This discussion paper may be returned with answers to the questions and with any suggestions of your own. While the answering of these questions is not absolutely necessary, a much greater benefit will be derived if others are allowed to profit by your experience. It will also help us to understand your point of view. The lesson may be used in the grange and in the club where these subjects are considered.

1. Are there breeding-places for house flies about your house?

2. Is it feasible to abolish these breeding-places?

3. Does fever and ague or malaria exist in your neighborhood?

4. Are you troubled by mosquitoes?

5. What is your worst household pest?

6. Have you any additional suggestions to make concerning the control of any of the above-mentioned insects?

Name..............................

Address..............................

Date......................

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VOL. III. No. 51 NOVEMBER 1, 1913 RURAL LIFE SERIES No. 4

A STORY OF CERTAIN TABLE FURNISHINGS

CLARA W. BROWNING AND EDITH J. MUNSELL

> The world is so full of a number of things,
> I'm sure we should all be as happy as kings.
>
> ROBERT LOUIS STEVENSON

True, the world is full of things, so many in fact that even the indispensable ones drift to the level of the commonplace. Yet each has a history, at once interesting and valuable, through which one may often trace the progress of the human race from savagery to barbarism and from barbarism to civilization.

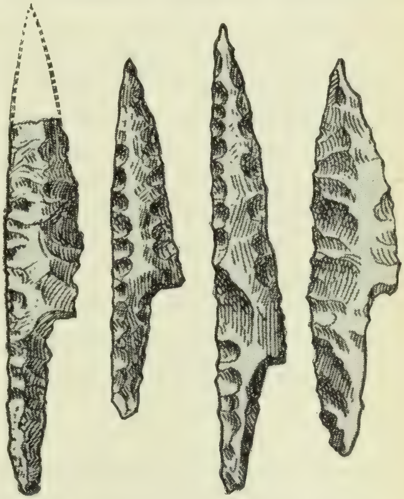

FIG. 28.—*Knives of flint. Old Stone Age*

The human being who lived thousands of years ago often seems to us unreal and mysterious. Did he enjoy life, or did he merely exist without gladness or sorrow? The relics that he left behind bring him nearer to us, just as the teacups or the miniatures that belonged to one's great grandmother serve to make her seem a real person. Little remains to tell the story of the man who dwelt in the shelter of rocks and trees, or in caves, save the implements by means of which he obtained and cooked his food. And, while much of the evidence is lost and much of it, wrought from perishable materials, has decayed, the significance of that which still exists is considerable.

Even knife blades, rudely fashioned, tell us of a struggle either for food or against an enemy. One of the blades may be better or worse than the others. It may indicate some degree of progress or originality on the part of the man who fashioned it, or a higher degree of civilization on the part of him who used it. The knife may have a handle, or the head of a reindeer may be scratched in outline on the blade. Perhaps such progress was slight if we consider that ten, or twenty, or fifty, thousand years may have elapsed between the lives of the two men who made the knives; but for this very reason the progress was sure. Real knowledge came slowly, and innovations were probably frowned on even by men of the stone age. They lived as they had seen their fathers live, and changed their modes of living to meet new conditions only as such conditions developed. They attempted to invent utensils for the serving of food no more readily than we should attempt to create a new form of tablespoon.

As time went on and the stone age merged into the age of metals, and this again into the historic period, man advanced more rapidly because he had the experience of his forefathers to build on. But the relics that have come down to us are always expressive of the tastes and the character of the people who owned them. A knife that is rude in workmanship may be efficient and serviceable; another may be both practical in form and beautiful in design; a third, bedecked with jewels and delicately carved, and dating, too, from a late century, may be of little use and may betray the poor judgment of the race that admired it.

The prehistoric stone age is divided into two periods: first, the Old Stone Age, the most flourishing part of which may have been some fifty thousand years ago; and secondly, the New Stone Age, which came to an end in Egypt about six thousand years ago, but which has continued in certain regions until almost the present day. This shows that at least a semi-civilization developed sooner in some parts of the world than in others. And, because of difference in climate or in the physical formation of the land, the interests and customs of men living in distant regions became diverse. Sometimes, even in comparatively recent years, the story of different utensils is imperfectly known. We must be content to use the imagination, and often to leave entire centuries untouched.

TABLE LINEN

For thousands and thousands of years there could have been no table utensils, since society never thought of demanding a table; and thus the question of prehistoric table furnishings may be dismissed at once. It is probable that coverings for the table were first introduced as a mark of respect in sacrificial ceremonies, after the human race had become partly civilized. Such occasions are frequently mentioned in our own Bible history. In *Numbers* iv, 7, we read:

> And upon the table of shewbread they shall spread a cloth of blue, and put thereon the dishes, and the spoons, and the bowls, and covers to cover withal. . . .

Among the ancient Greeks tablecloths were unknown; nor would their use have been welcomed had the custom been introduced, since the Grecian banquet table was elaborately carved and its beauty was intended to enhance the splendor of the feast. It was customary, however, for guests to wash their hands both before and after meals and to wipe them with towels that answered the purpose of napkins. The towels were removed during the feast, but frequently pieces of bread were used for cleansing the fingers. Before the beginning of the Christian Era, the table customs of the Romans were similar to those of the Greeks. The use of napkins (*mantelia*) is frequently referred to, but no mention of tablecloths is made. In an account of a banquet (*Æneid* I, 701,), the poet Vergil (70-19 B. C.) writes:

> Servants pour water on their hands, serve corn from baskets, and bring napkins with close-cut pile.

During the first century after the birth of Christ, the word *mantelia* appeared as the designation of a covering for the table, and a new word, *mappa*, was adopted for the napkin. Both the tablecloths and the napkins of this period were made of linen, which had to be imported from Damascus, Tarsus, or Alexandria, for only coarse homespun linen was woven in Italy.

After the fall of the Roman Empire, tablecloths made from costly materials and heavily embroidered came into fashion, and the linen industry underwent a long eclipse. During the tenth century the manufacture of table linen was revived in Flanders, and after the Norman conquest it became a popular occupation in England. In the home of the Saxon Cedric (1189-1199), as described in Scott's *Ivanhoe*, we have mention of a scarlet cloth being laid on the table. Even before the conquest our Old English ancestors used tablecloths, the long ends of which often served for napkins as well. Like the Hebrews and the Greeks and the Romans, they were accustomed to wash their hands and to wipe them with towels before and after the feast. Not until the reign of Queen Elizabeth, however, did the fashion of using individual napkins become established; when it did come, the fashion was carried to the extreme. The writer Pepys (1660-1669) tells us that professional table-setters were hired to lay the napkins in figures of all sorts, and that such men earned unusual prices by their trade. Moreover, for one of his own dinner parties he professes to be:

> mightily pleased with the fellow that came to lay the cloth, and fold the napkins, which I like so well, as that I am resolved to give him 40s. to teach my wife to do it.

But although extravagance and display marked its introduction, the convenience of the table napkin justified and standardized its use.

KNIVES

The knife with which you cut your meat to-day is the result of a slow development from the most remote ages. The human race cannot long have existed before necessity prompted the use of a rude cutting instrument with which game might be killed and then divided. The knife was chipped out of flint or stone, like those belonging to the Old Stone Age (Fig. 28), although originally such instruments may not have been fashioned at all beyond the rude shape that nature gave them. Sometimes they were formed from other materials than flint or stone. People who lived near the seacoast are known to have had knives of shell; others used the bones of animals; still others sharpened tough pieces of wood. For ages the same implement served indiscriminately on the field of battle, in the chase, and at meals. Finally it took different shapes according to the use to which it was to be put: a curved blade was used for whittling, a straight one for domestic purposes, and a pointed, or dagger-shaped, knife served as a weapon.

When history opens, men are already using knives of copper. Somewhat later tin was added to the copper, and bronze instruments resulted. Bronze continued in favor until the time of Cæsar, but iron had come into use a thousand years before. The steel of Damascus gradually took their places.

In literature the earliest mention of the knife has reference to its use in the sacrifice. We are familiar with the reference in the Bible (*Genesis* xxii, 10):

> And Abraham stretched forth his hand, and took the knife to slay his son.

As for Hellenic civilization, frequent references such as the following may be found in the works of Homer (800 or 900 B. C.):

> So spake Priam, and cut the lambs'
> throats with the pitiless knife.

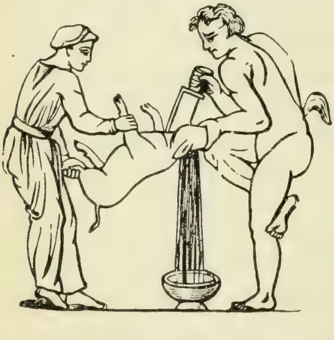

FIG. 29.— *Knife used in the sacrifice*

The Greek word knife (μάχαιρα) is derived from a verb (μάχομαι) which means *fight*, and refers to a large knife worn by heroes and used by them for slaughtering animals; but, since the Greeks were in the habit of feasting on their sacrifices after the ceremony was over, we can readily imagine that this knife would often be used in carving meat. In the works of the historian Herodotus (440 B. C.) we have reference to its use as a carving knife; Pherecrates, a comic poet who flourished about the same time, mentions a knife for cutting meat on one's plate in the following dialogue:

> A asks B: Have you placed the knife on the table?
> B answers: No.
> A asks: Why have you hindered me from eating? How can a toothless old man get at the beef without a knife?

And, since the old gentleman had to insist so vehemently on using a knife, we may assume that table knives were scarcely known. In fact, it would be impossible for guests to use a knife with comfort, since they reclined on couches and rested on one elbow while eating.

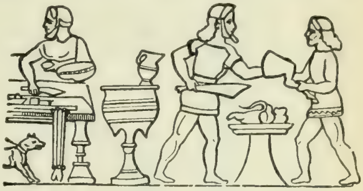

Fig. 30.—*Knives used for carving*

At the beginning of the Christian Era table knives were still without favor. That they were used to a limited extent is indicated by the fact that ivory-handled knives have been found in Roman tombs beside dishes of food. There are certain monuments depicting banquet scenes, at which the guests were provided with knives, but ordinarily the food was cut before being placed on the table. We learn from Clement of Alexandria that by the second half of the second century the table knife had become common in the Roman Empire.

But certain it is that until the fourteenth century the table knife did not appear in a class by itself. Up to that time the guest attending a dinner party provided his own, or, if he failed to do so, used his fingers. Within another century, however, the table knife became so popular that three distinct kinds of knife were manufactured: a small knife used in eating; a carving knife with a broad blade; and the parepain, or bread-peeler, designed to trim the crusts from flat pieces of bread, which were often used instead of plates. When these "plates" went out of use in the sixteenth century the parepain was no longer needed.

During the first half of the seventeenth century Cardinal Richelieu, the founder of the French Academy, became offended by the rude manner in which pointed knives were used, and thereafter caused his knives to be rounded. Before long the fashion was generally adopted and the pointed blade, which, in lieu of a fork, had been useful in picking up pieces of meat, was abandoned. Since the seventeenth century, the form of the table knife has remained substantially as we know it.

SPOONS

There can be little doubt that the spoon has come down to us from remote antiquity, and that prehistoric man must have felt the need for it almost as soon as he discovered the use of a knife. The original form of the spoon and the material from which it was made must remain for us a matter of conjecture. The Greek name for spoon (*Κοχλιάριον*) is derived from a word meaning *shell*, which would suggest that the shells of mollusks and oysters were first used. Later, bone and wood were undoubtedly utilized. There are in existence Egyptian spoons of glass, stone, marble, wood, and ivory, curiously wrought, and dating from the fifteenth century before Christ (Fig. 31); but these, of course, represent humanity in a well-developed stage of civilization.

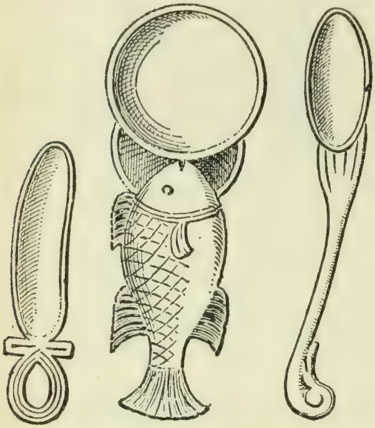

FIG. 31.— *Ancient Egyptian spoons: the first of gray-green slate; the others of carved wood*

The spoon made its appearance on the table long before the table knife was known. Even in the Old Testament may be found various references to golden spoons used for special purposes in connection with the sacrifice. Among the early Greeks, with whom soup and porridge were popular dishes, pieces of bread at first served reasonably well as spoons; but since table knives were not in fashion, and since oysters, snails, and eggs appeared on every banquet table, metal utensils became an actual necessity. These were often made of gold, and the bowl, although it terminated in a point, was broad and hollow. Thus the pointed end could be used in opening foods served in the shell, whereas the bowl was adapted to the eating of liquid food.

The Romans, like the Greeks, used spoons to convey to the mouth what the fingers could not manage. Relics of various kinds have survived. A silver spoon has been dug up in the ruins at Herculaneum, and silver, bronze, and ivory spoons have been unearthed at Pompeii. Others were found in Rome. Two kinds seem to have been in general use, the ligula and the cochlear. The ligula was shaped much like our own tablespoon. The cochlear had a much smaller bowl than the ligula, was circular in shape, and very slightly hollowed. Its handle was pointed for convenience in removing oysters from the shell and in lifting food to the mouth, and it really combined the functions of knife, fork, and spoon (Fig. 33). Silver plate was not in general use in Italy until after the Roman conquest of Greece. Before the conquest, Roman noblemen were not too proud to borrow silver table utensils from

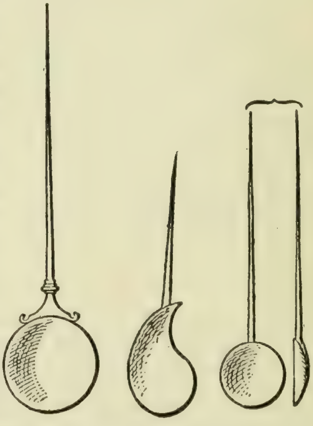

FIG. 32.—*Ancient Greek spoons of bronze*

their neighbors on state occasions. After the wealth and luxury of the East crept into Italy, however, silver, and even gold, plate was plentiful.

The carvings and the decorations on spoons of various periods reflect the interests and the beliefs of the people who used them. Both Greek and Roman spoons are likely to have figures of the gods carved upon them. The early Christians crowded the handles, and even the bowls, of their spoons with symbolic characters. On one may be found the sign of the cross, on another a crown of thorns or the figure of a lamb or a fish. Later there arose a class known as apostle spoons. These were often presented at christenings in sets of twelve. Each spoon had the figure of one of the twelve apostles carved on its handle (Fig. 34). From the later Middle Ages, spoons of silver washed over with gold and set with rubies, or spoons "of pure gold, with four pearls set in the broadest part of the handle," have come down to us. For such workmanship, kings and nobles paid to the goldsmiths vast sums, mention of which is frequently made in the royal inventories. Those who were not wealthy used spoons of pewter, brass, and tinned iron. Even wood and bone spoons were used until late in the sixteenth century. From the thirteenth century on, however, a limited number of silver spoons were common even in the less pretentious households. We are told that in 1474 the pewterers in England asked that the importation of leaden and tin spoons might be prohibited for the protection of their industry, and that thereafter pewter utensils became very common.

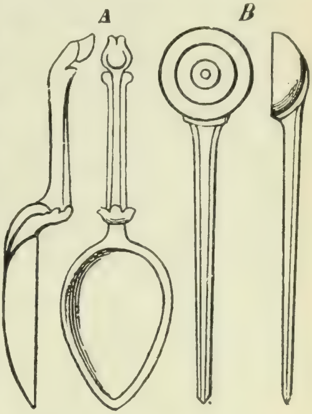

FIG. 33. — *Roman spoons. A, ligula; B, cochlear*

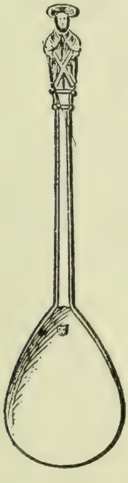

FIG. 34.—*Apostle spoon, with fig-shaped bowl*

It will be noticed that the medieval spoon shown in Fig. 34 has a fig-shaped bowl, wider at the base and narrower next the stem. During the seventeenth century the bowl gradually became wider in proportion near the stem and narrower at the base, thus assuming an egg-shaped form with the small end downward (Fig. 36). It was not until after the days of the Commonwealth (1660) that the stem, which had been as great in thickness as in width, became flattened, gradually expanded from the bowl upward, and rounded off at the top.

Spoons of standard sizes, which are so familiar to us, have not long been in general use. The teaspoon, for example, is of comparatively recent introduction, for tea itself seems not to have been imported into Europe until the seventeenth century. The dessert spoon likewise was unknown in England until after the Restoration. Saltspoons and after-dinner coffee spoons also are modern inventions.

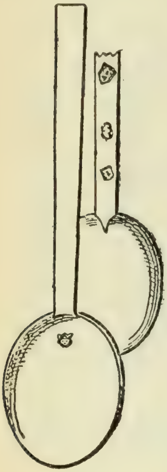

Fig. 35.—*Puritan spoon, with flattened handle and rounding bowl*

FORKS

A sharp piece of flint naturally suggested itself to prehistoric man as a cutting implement; an oyster shell served his purpose as a spoon or ladle. It required no little skill to fashion a forked implement, however, and there was little in nature to suggest the idea. For this reason we may be sure that the fork is of far more recent origin than either the knife or the spoon. In Fig. 38 is shown one survival of the New Stone Age (found in the shell heaps of Denmark) which indicates a development of the fork form, but as to its use we can only conjecture. It might have been a comb or the original oyster fork. Who can tell?

Among the ancient Egyptians and the Hebrews, two kinds of fork were known. In *1 Samuel* xiii, 21, we read:

> Yet they had a file for the mattocks and for the coulters, and for the forks.

These may have been hay forks, or possibly spading forks, that were employed by husbandmen. The Egyptians used bronze forks also for lifting sacrificial offerings out of seething pots, and such implements have even been found in Egyptian tombs. Among the Greeks and Romans the sacrificial fork usually had five prongs and was used in roasting pieces of meat over the fire. More often, however, a long, pointed stick, called an obelus (ὀβελός), was used for supporting the meat (Fig. 37).

Strangely enough, the obvious use of forks for table purposes seems not to have occurred to mankind until a comparatively modern date. If forks had been used, there would surely be found some surviving relics, or, failing that, pictures of them in banquet scenes or references in contemporary literature. On the other hand, in Homer and Ovid there are distinct references to the use of the fingers in conveying food to the mouth; and we are all familiar with a reference in the account of the Last Supper.

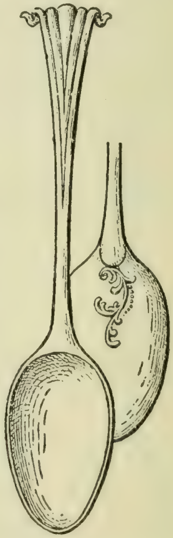

Fig. 36.—*Spoon of the "Onslow" pattern, with egg-shaped bowl*

In the writings of an Englishman named Heylin (1662) occurs the following statement:

> The use of silver forks, which is by some of our spruce gallants taken up of late, came from China into Italy, and thence into England.

Heylin's statement is supported by many who assert that beyond a doubt our table fork is descended from the same ancestor as that of the Chinese chopstick. The chopstick resembles a tapering pencil in appearance; it would seem not to be a more convenient utensil than the Roman spoon shown in Fig. 33, the handle of which, we have found, was sometimes used in eating bits of meat or fish. Whatever its origin, the instrument first used in Italy assumed the form of a two-pronged fork, like the fork in a carving set of the present day.

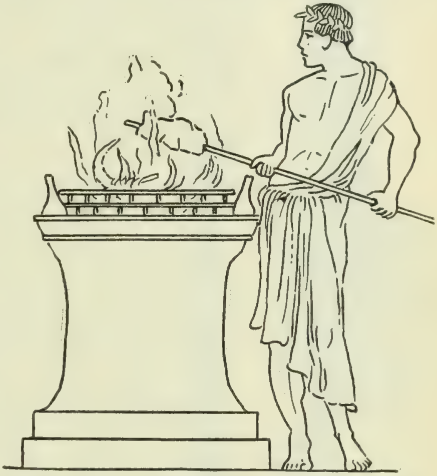

FIG. 37.— *A Greek, roasting meat on the obelus*

Humanity waited long for the fork, yet was loth to adopt the improvement after it had been introduced. A silver fork was found in the ruins at Pompeii and one or two others were unearthed at Herculaneum, each of which must date from the first century. In representations of feasts previous to the sixteenth century, forks are rarely shown on the table; and during the earlier Middle Ages, we are told, they were used as instruments for roasting meat over the fire, and not for table purposes. When such was not the use, the occasion was judged worthy of comment. Thus in certain records of the eleventh century St. Peter Damian mentions the wife of the Doge of Venice, a lady from Constantinople, as having the strange whim of eating with a golden fork. Edward I of England (thirteenth century) owned a fork, which in all likelihood had been brought from the East as a curiosity by a crusader. More frequent mention is made of forks in the inventories of the fourteenth century, but their number in each instance bears no proportion to the number of spoons; and as a rule the forks seem to have been designed for special purposes — perhaps for eating sugarplums or other dainties toward the end of a feast. Piers Gaveston (1313), the pampered favorite of Edward III, had three silver forks for eating pears — an additional evidence of his effeminacy! Forks are mentioned in the royal inventory of Charles V (1379), and

Voltaire says they were used by the Lombards during the fourteenth century.

The fork appears with some regularity in inventories of noble houses after the fourteenth century, but in most European countries it remained isolated as compared with knives and spoons. Toward the latter part of the fifteenth century, during the Italian Renaissance, Italy adopted the fork and set the fashion of using it as a table utensil. In fact, it became so common there that an Italian who visited the court of the King of Hungary between 1450 and 1490 marveled at the lack of forks in the table furniture of that king. In Sweden, France, and England the appearance of the fork was equally delayed. At a banquet given by the Duke of Burgundy to the ambassador from England in 1462, it is recorded, the guests ate with their fingers. Almost a century later (1561) Mary Queen of Scots left the brilliant court of Henry II, and at that time she was not accustomed to the use of the fork; she would have been had King Henry already adopted it. Queen Elizabeth of England (1533-1603) was not guiltless of using fingers to help out spoon and knife. She had received several forks as gifts, but was so chary of their use that it is doubtful whether she ever used them. An extract from Her Majesty's inventory may be interesting and will show that the forks were mainly for ornament:

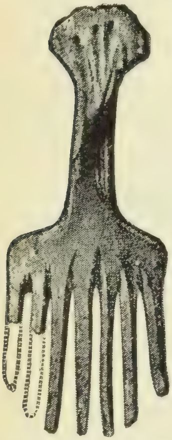

FIG. 38.—*A forked implement made of bone, found in the shell heaps of Denmark. New Stone Age*

> Item, a knife and a spoune, and a fork of christall garnished with golde sleightly, and sparchs of garnetts; given by the Countess of Lyncolne. Item, a knif of corall slightly garnished with golde; given by Mrs. Frances Dury. Item, one spoune and forke of golde; the fork garnished with two lyttle rubyes, two lyttle perles pendant and a lytle coral; given by Countess of Warwicke.

In an account of a dinner as late as 1598, it is stated that the Duchess of Beaufort extended one hand to Henry IV of France as she dipped the fingers of her other hand into a dish. Until 1598, therefore, fingers were still used instead of forks in the highest and most refined circles. Franklin assures us that the use of forks did not begin to be introduced in the high society of France until 1600, that during the seventeenth century most persons ate with their fingers, and that not until the eighteenth century were forks used regularly by all classes of society. In 1611 there was published a book, called *Crudities*, written by Thomas Coryat, in which, in an account of his travels in Italy, he says:

> I observed a custome in all those Italian Cities and Townes through the which I passed, that is not used in any other country that I saw in my travles, neither doe I think that any other nation in Christendome doth use it, but only Italy. The Italian and also most strangers that

> are commorant in Italy, doe alwaies at their meales use a little forke when they cut their meate. For while with their knife which they hold in one hand they cut the meate out of the dish, they fasten their forke which they hold in their other hand upon the same dish . . . . from which all doe cut.

Thus the Italians had solved the problem of obtaining food from the common dish and not touching it with the hands. Coryat so liked the custom that he adopted it himself and had a fork made which he always carried with him and used. This earned for him the epithet *furcifer* (fork-bearer), and brought considerable chaff on him and on others who later followed his example. The idea was ridiculed and made the subject of caricature, and even preached against. One divine stated that it was an insult to Providence not to touch one's meat with one's fingers. The custom was considered by many as effeminate, foppish, and affected.

But the turning point was near at hand. The fork had been fighting for existence, and its practical value commended it despite the company who introduced it. Both John Fletcher and Ben Jonson comment on the use of silver forks among the better classes of society, and mention the use of iron forks among the lower classes.

After the middle of the seventeenth century, the history of the fork chiefly concerns its spread from the aristocracy to the more humble circles. Even during the eighteenth century it was customary for a gentleman, when traveling, to carry a case containing his own knife and fork, since the inns and public places had but a meager supply.

For centuries the two-pronged instrument, bedecked with jewels and inlaid decorations, prevailed. This type gradually gave way to simpler forms that enabled the fork to come into more general use. Even the first steel forks made at Sheffield, England, had only two tines, but by and by a three-pronged fork made its appearance. The four-pronged fork, conveniently curved and adapted to the purpose for which it is used, is of comparatively recent origin. It is said that only two of those in existence are known to date from the seventeenth century.

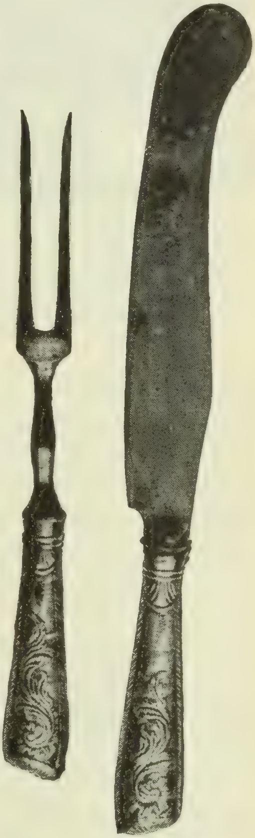

FIG. 39.— *Table knife and fork from the Connecticut State Service during the term of Governor Tomlinson (1827–1837). The etiquette of the time demanded that food be eaten from the rounded end of the blade*

DISHES

No relics are more interesting than the rude pots in which primitive man cooked his food and prepared his beverages, and no class of relics has been preserved to us in greater numbers. Two reasons for this abundance are evident: first, the imperishable nature of sun-baked clay; and secondly, the slight pecuniary value of such utensils, which rendered them safe from destruction by conquering races.

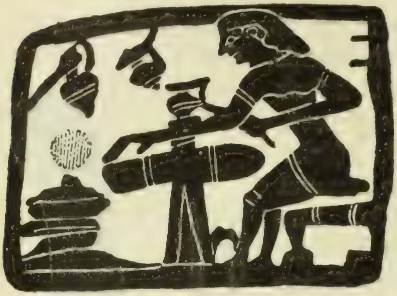

FIG. 40.— *Potter's wheel. In the center of this revolving disk a piece of clay of the required size was molded into shape. After the clay had hardened, the pottery was replaced on the wheel for decoration*

The use of clay for the making of pottery has without doubt been discovered independently by the rudest savages in all parts of the world. Their very footprints, perfectly represented in the damp earth, would suggest to them its plasticity; and to men who knew the use of fire, as men did even during the Old Stone Age, a knowledge of the baking of clay could scarcely fail to come. The savage might first avail himself of the dried fruits of trailing vines to serve his purpose as cooking utensils, and smear the gourds with moist earth in order to protect them from fire. Before long he would be forced to appreciate the permanent nature of the earthen shell and perhaps be willing to dispense with the gourd entirely.

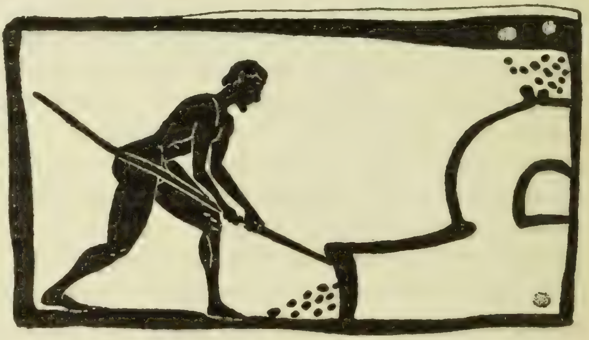

FIG. 41.— *Ancient kiln. At the base of this dome-like structure is a door on which the person in charge could stand, if it were necessary to reach the hole at the top of the kiln and check the draught. Pottery was conveyed to the oven through the door in the side of the kiln*

For thousands of years primitive man patiently shaped his pottery by hand; and very cleverly was the work of molding done— so cleverly, in fact, that in many cases no one is sure whether or not the maker knew the use of a potter's wheel. This invention, which in fundamental idea is in use in potteries to-day, was discovered before the time of Mena, who reigned in the fourth millennium before Christ. After it had been molded, the pottery was allowed to dry. Occasionally, before the clay had hardened, some simple form of decoration was incised on its surface with a sharp stone. The separately modeled parts, such as handles, feet, or mouths, were added shortly before the pottery was placed in the kiln, or furnace, for firing.

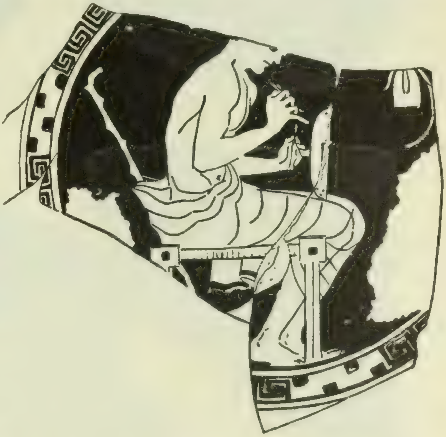
Fig. 42.— *Vase-painter using feather brush*

The earliest pottery was made from inferior clay that was coarse and filled with grit. Gradually men learned to look for finer, whiter materials, and to wash them so as to make them whiter than before. When the oven in which the pottery was baked was heated to a higher temperature, harder, better ware resulted. One serious difficulty had yet to be overcome: the clay was porous, absorbed moisture, and therefore did not prove a satisfactory material for holding liquids. This led to the discovery of a varnish that would seal the exterior of earthen vessels and render them proof against leakage. Later, a glaze was discovered that not only improved the practical value of the ware but made it more attractive as well.

Prehistoric pottery

So much prehistoric pottery has been found belonging to different ages and to different nations, that it would require many pages even to enumerate the various kinds. Though it is a temptation to dwell exhaustively on each, it is necessary to confine our study to a few. Many specimens have descended from the New Stone Age, some rude in workmanship, others betraying unusual skill. In Fig. 44 are shown several very fine and very early types, which for simple beauty of form can scarcely be surpassed.

In early times the greatest center for the production of pottery, and the field of the most remarkable achievement, was Egypt. Even during the New Stone Age the Egyptians are said to have made great progress in the manufacture of a red and black earthenware, for which they later became famous. As early as 4000 B. C. they were noted for the making of a translucent, turquoise-colored glaze with which they covered their pottery, and they understood also the composition of glass. Moreover, they had progressed so far in the art of decorating that even the Greeks,

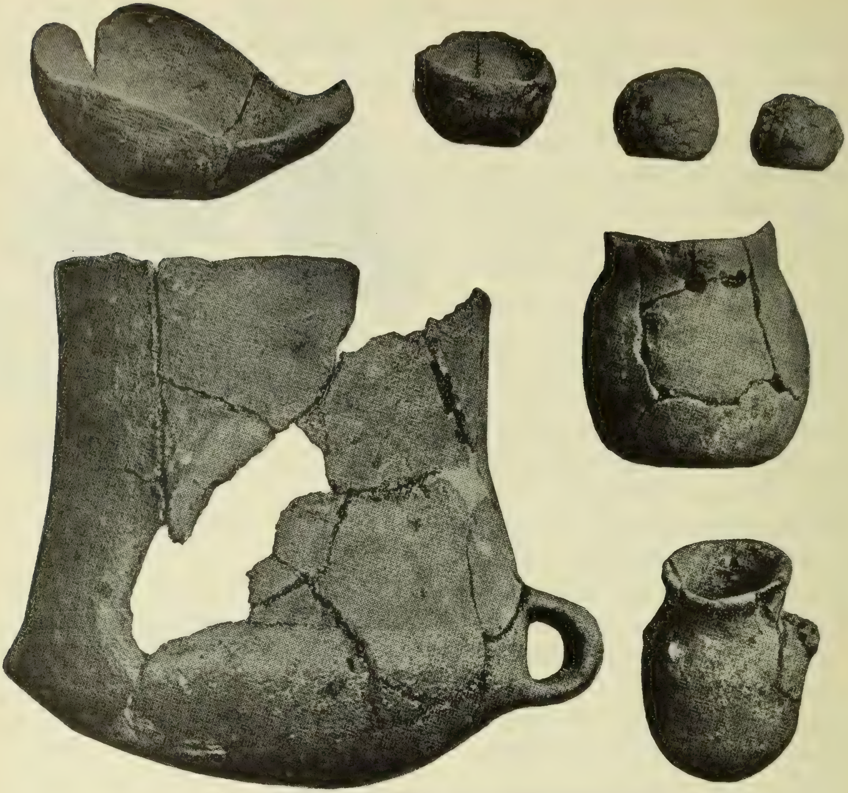

FIG. 43.— *Prehistoric pottery of the neolithic period*

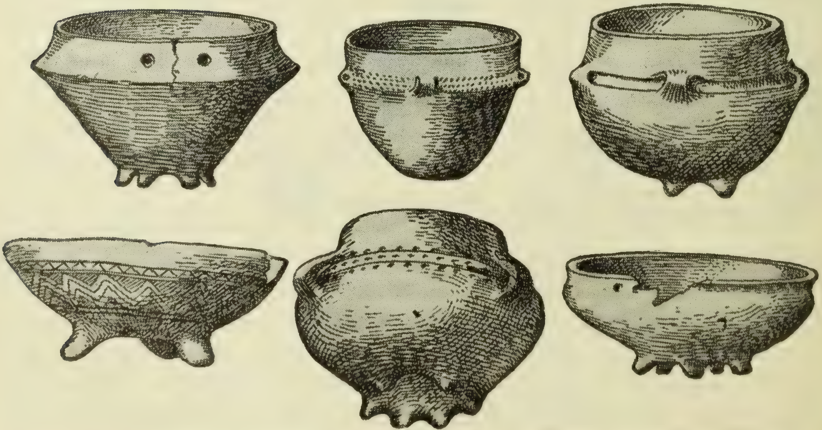

FIG. 44.— *Pottery at the end of the neolithic period. Found in southwest France*

some centuries later, were not ashamed to imitate them. The Egyptian influence is marked in Asia Minor, in Crete, and in Palestine, although each of these regions had a well-developed pottery of its own. In Babylonia and in Assyria, there has been found not only rough pottery, but also glazed and enameled ware of a superior type. Centuries later the Persians and the Arabs profited by the knowledge of their predecessors, developed the art of making pottery, and bequeathed it to the Moors. The Moors in turn carried it into Spain and eventually taught it to the Italians.

Greek pottery

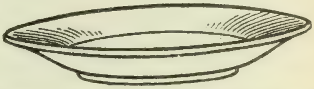
Fig. 45.— *Pinax, or plate with depression for sauces that were poured over fish*

The Greeks have often been characterized as a laughter-loving people who knew how to live to the full every hour of the day. At no time more than at meals was this characteristic evident. The food might consist merely of bread and barley broth, together with figs and honey or olives and cheese; but, no matter how simple the repast might be, the Greek reclined comfortably on his couch, forgetful of care and conscious only of the happy hour that he was enjoying with his family. Later in the day he might dine with his friends at the public tables, and here also would be felt an atmosphere of relaxation and enjoyment. It must not be supposed, however, that the Greek people were uniformly frivolous at meal time. On the contrary, some of their most wonderful philosophy has been handed down to us as table talk, and much of their noblest poetry and finest music they learned from the bard who played the lyre and sang at the conclusion of the feast. And there is strong probability that this leisurely dinner helped to make them the enterprising and intellectual people that they were, since we know now that digestion is aided if the meal hour is made a pleasure-time.

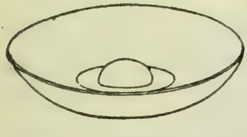
Fig. 46.— *Phiale, a bowl-shaped saucer, with no handle but with a place for thumb or finger in the center*

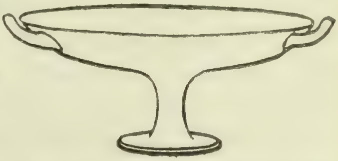
Fig. 47.— *Cylix, from which wine was drunk at banquets*

A second characteristic, typical of the Greek, was his instinctive love of beauty. His ideal may best be expressed, perhaps, in a few words from a prayer that Socrates on one occasion uttered to the god Pan:

> Give me beauty in the inward soul and may the outward and the inward man be at one.

If the Greek was to be happy he had to be in sympathy with his environment. As a result, the home, and more particularly the dining hall, the tables, and the dishes that appeared on the tables, were expressive of his lofty artistic instincts, and doubtless the barley broth and the figs and the olives tasted all the better for their surroundings.

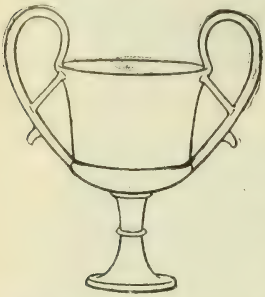

FIG. 48.—*Kantharos, a two-handled drinking-cup*

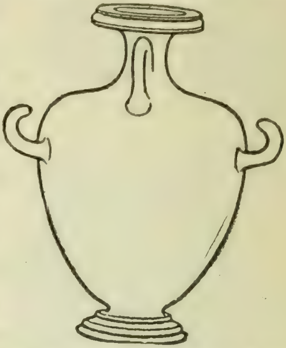

FIG. 49.— *Kalpis, used for carrying water*

The dishes of the Greeks were unlike our own — not so different in shape, perhaps, as one might imagine, but different in size and material and decoration. There were large earthen platters on which meat was served. and plates and saucer-like dishes for fish. There were likewise receptacles for vinegar and sauces, and small boxes for sweets and spices. But most interesting of all were the vases, vases of all shapes and sizes, which were used for many purposes. Several kinds were for oil or perfumes, others for fruit or flowers; still others, of perhaps the most attractive shapes, were wine jars and drinking cups.

The primitive pottery of the Greeks (2500-600 B. C.) was made from yellow or yellow-brown clay and ornamented for the most part with simple geometrical lines (Fig. 53). From 600 to 400 B. C., a red clay with glossy finish was used, and was decorated in shining black with mythological scenes. Sometimes the figures were left in the red and only the background was painted. As early as the fifth century before Christ, a coating of white clay was often applied to the surface of the vase, and decorations were made in purple, brown, yellow, or crimson. Dishes of gold, silver, and bronze have sometimes been found, similar in size and shape to those made of clay, but there are comparatively few good examples subsequent to the Mycenæan period (900 B. C.).

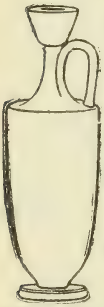

FIG. 50.— *Lekythos, or vase used for holding oil*

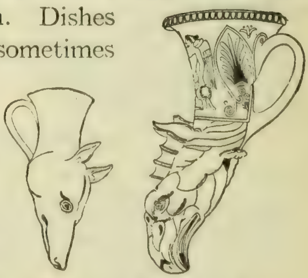

FIG. 51.—*Drinking horns*

In Fig. 52 is shown an earthen pot that is typical of the early prehistoric period. The separately molded handles and the absence of decoration at once betray its crudity. This pot was used in Mycenæan times.

The jug shown in Fig. 53, a survival of the late Mycenæan period, is known among archæologists as the "false-necked amphora." The form of the vessel would suggest that it was used for holding liquids, such as wine, milk, or water, which must be kept free from evaporation and from dust. The substantial handles that are bridged across the top seal the natural opening, but the spout arranged on one side permits the contents of the jug to be poured forth if it is merely tilted on its base. Decoration was applied in the form of bands that ran continuously around the vessel. The bands are really groups of lines of varying width.

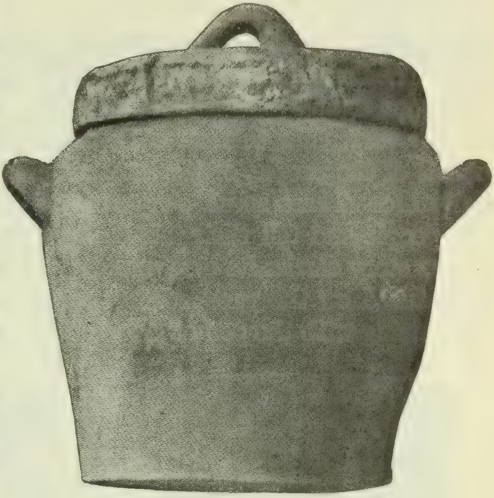

Fig. 52.— *Mycenæan pot*

The drinking cups from Vaphio, in southern Greece (Fig. 54), are also representative of the work of the Mycenæan period. The figures on the cups were formed by beating the metal outward from the inside. The animation and the naturalness of the cattle are worthy of notice.

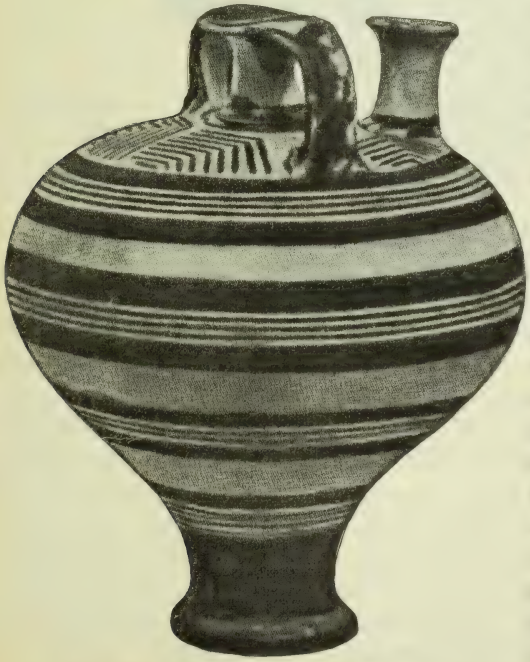

Fig. 53.— *Mycenæan vase, about 900* B.C.

The krater (*Κρατήρ*) in Fig. 55 is typical of the best Greek pottery. The strong flowing curves of this vessel are at once dignified and beautiful. The low, snug handles invite the bearer of the jug to place his thumbs firmly through them as he carries his heavy burden. The substantial base insures the safety of the vase; the wide, flaring mouth offers a generous surface for dipping.

When the Greek had made sure of appropriate forms, he next turned his attention to decoration. The bands composed of a geometrically repeated unit, as seen in the krater in Fig. 55, are highly decorative; they are in just as good taste on dishes of the present day as on vases centuries old. The flower of Greek vase painting was the decorative band, or frieze, of human figures and animals, which the Greeks applied to the bowl part of the vase. On this were depicted scenes representing the religious beliefs of the people, or the intermingling of gods and men, or pictures of daily life. These speak eloquently of the high ideals and refinement of the people and tell their tale in a simple decorative way, while the spirit of the story carries its own meaning. How eternally human is the theme introduced on the vase in Fig. 55! Here is represented a Greek bride conversing with the god of love. In one hand she holds a mirror, in the other an apple, a token of the goddess Venus. And thus the commonest household object was often exalted above the lower level of utility and received a spiritual meaning, becoming a thing of beauty and a joy for ever.

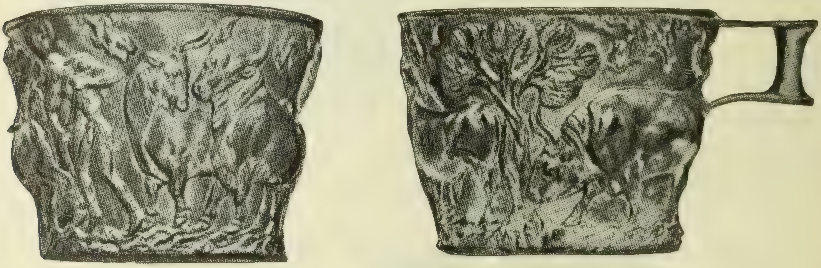

FIG. 54.— *Gold cups from Vaphio*

Roman pottery

In almost every respect Roman pottery is inferior to Greek. It is less artistic in shape and less original in design, though often it is merely an imitation of the Greek. Nor could better results have been expected. The Greek worked out his art for the love of it; the Roman adopted what the Greek left behind, and added to it on his own responsibility enough to satisfy his sense of luxury and display. The work of the Greek was characterized by beauty and restraint, that of the Roman by lavishness and ornate design. During the last century before Christ, when Greek influence was at its height in Italy, fashion demanded gold and silver plate, with heavy chasing, for tableware. Those who could not afford gold and silver at least wanted to have pottery molded in imitation of the chased dishes, and adorned with heavy figures in relief. Such decorations were molded in stamps and afterwards attached to the vases. Thus artistic ability was demanded only in designing the stamps that could be used for numberless vases. The potter, not the master painter, added the finishing touches by spreading over the surface of the clay a preparation that rendered it similar to metal in appearance and made the imitation complete. So early did insincerity and sham mark the inroads of luxury.

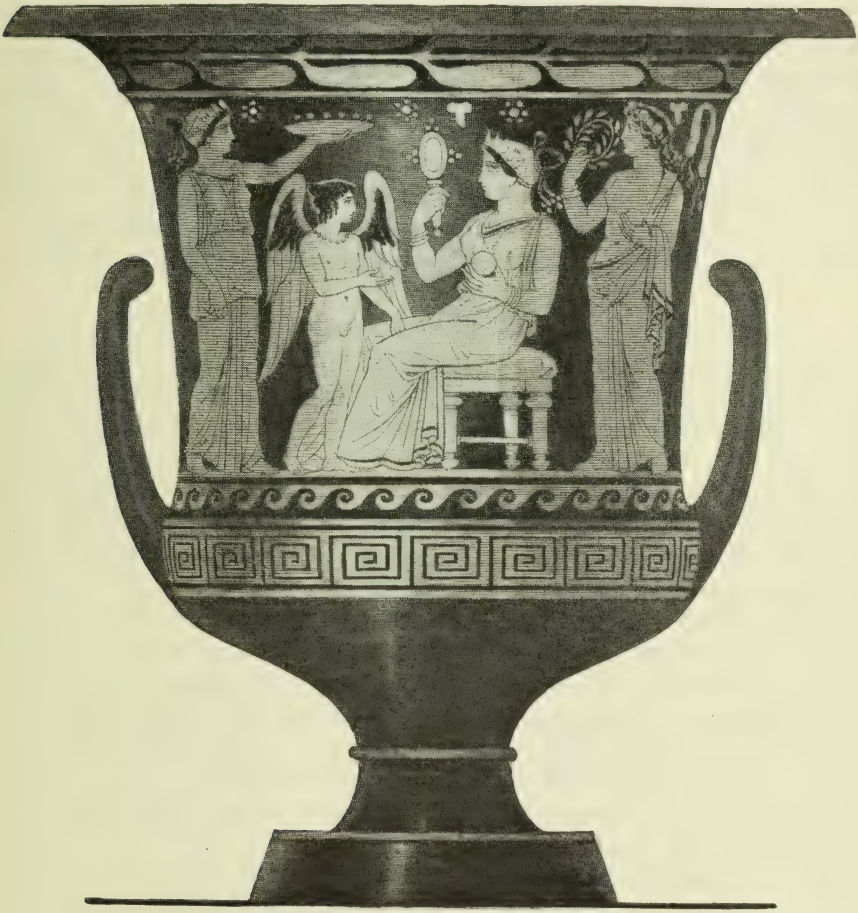

FIG. 55.—*A typical Greek vase*

Medieval tableware

To describe the dishes that appeared on the table during the medieval period as we have those of the Greeks would for several reasons be a difficult task. In medieval Europe there were great differences of caste, and the peasants knew little concerning the appointments of the rich man's table. Men began to travel and to bring home new ideas, and new customs sprang up in different localities. Finally, men were no longer content with dishes made of clay, and in their search for new materials a medley of different types resulted. The wealthy used dishes of gold and silver, such as platters, cups, bowls, and saltcellars. The huge saltcellar, usually made of silver and often grotesquely ornamented, might be seen on almost every table. The latest inventions in earthenware, the nobility were likewise able to afford. For the humble needs of the poor, dishes of wood and cups of bone, with an occasional piece of better ware, were usually sufficient. Instead of describing certain chance dishes that remain, it will be more satisfactory to trace briefly the development of pottery from the end of the Roman period to the present.

Earthenware since the beginning of the Christian Era

After the conquest of Italy by the barbarians, interest in pottery waned. The Christian nations manifested little care in its manufacture — and no wonder, for Christianity was spreading northward among frank-hearted, but uncultured, people. Before the fifteenth century, only a leaden glaze was known. From the year 1100 this was in use in the Italian city of Pesaro, and the potteries of Italy were the best developed of any in Christian Europe. The glaze was transparent and allowed the yellowish or red bisque of the body to shine through.

Sometime before the eleventh century the Moors introduced a new kind of pottery into Spain. It was distinguished from the Arabian and the Persian wares, from which it had descended, chiefly by the metallic luster and the whiteness of the glaze. This pottery is known as Hispano-Moresque; its manufacture became centered on the island of Majorca in the Mediterranean. The groundwork of the ware was a white enamel, obtained through a mixture of tin, and the ware was decorated with stars and medallions in blue and with long-leaved foliage in pale yellow. From Majorca the enamel found its way to Italy under the corrupted name of *majolica*, and is supposed to have been introduced into that country by Luca della Robbia, the sculptor (1400-1481), who used the enamel to advantage in his reliefs. After Della Robbia, majolica flourished until the middle of the sixteenth century, but about fifty years later the original product had almost entirely disappeared.

During the twelfth century the leaden glaze became known in France, and white enamels were subsequently imported from Italy. From France the knowledge was carried to Holland, and in both countries large industries sprang up. As for England, little can be said of the development of pottery until 1720. At that time the son of a Burslem potter in Staffordshire noticed the whiteness of some silica powder used by a veterinary surgeon, and conceived the idea of mixing it with potter's clay. He was even more successful than he had hoped. The body of the ware not only became whiter, but was exceedingly hard and lent itself easily to decoration. It was brought to the highest degree of perfection by Josiah Wedgwood, another potter of Burslem, who started his factory in 1759. Wedgwood manufactured a cream-colored ware, which soon became known as queen's ware owing to Queen Charlotte's patronage; and from that time its popularity was assured. This type of ware has persisted to the present day and is used on the table by many housewives. It is known by various names: "c. c. ware," white earthenware, ironstone china, and white granite ware; these names designate all pottery with a white, or nearly white, porous body that is covered with a glaze.

Porcelain

The name "porcelain" is derived from a Latin word *porcellana*, meaning a sea shell. The new ware is thought to have reminded those who saw it of this shining toy. Porcelain is made of essentially the same materials as is white earthenware, used in proportions that produce an impervious or a nonporous body and burned so hard as to be translucent. The translucence, or the quality of transmitting light, of Chinese porcelain constitutes the chief difference between china and the cream-colored ware.

The story of porcelain begins in China two hundred years before the birth of Christ. The porcelain of the earliest period is scarcely recognizable as such, being grayish, thick, scarcely translucent, and full of minute cracks. Until the twelfth century none of the ware seems to have appeared in Europe, but at that time it reached a high degree of perfection. Even in the twelfth century the place of its origin was not known, but the Venetian, Marco Polo, who returned from China in 1292, told of the manufacture of porcelain there. Subsequently, more and more pieces were imported into Europe by the Venetians, and in the seventeenth and eighteenth centuries the French, Dutch, and English East India Companies promoted the trade. Strange myths and legends accompanied the ware. Porcelain was said to be "composed of materials that had lain for thousands of years buried in the earth," and a cup of porcelain was warranted to change color and fly into pieces the moment poison was poured into it — a rare protection for monarchs who feared treachery at any meal!

Of course the European nations wanted to know how to make the ware, but the secret could never be obtained from the Chinese. First of all the Italians made the effort (1575-1585). They obtained a very attractive product, too, made by mixing impure China clay, a fine white sand, and a considerable proportion of glass. But the Italians soon became discouraged, and nearly a century elapsed before interest was again aroused in the subject. At this time France made the effort, and eventually a thriving industry sprang up in many French towns, notably one at Sèvres under the proprietorship of the king. The French product was an artificial porcelain composed largely of glass with a small admixture of clay. For the making of true porcelain some raw material was evidently necessary, the nature of which only the Chinese knew and they would not tell.

In 1701 the alchemist, Johann Friedrich Böttger, under the patronage of the Elector of Saxony, was endeavoring to accomplish the dream of all alchemical philosophy — the manufacture of gold. What he obtained was a handsome red stoneware as hard as porcelain, which greatly pleased the Elector and caused him to urge Böttger to attempt the production of white porcelain. The legend goes that about this time a new white powder was put on the market for toilet purposes, and that Böttger bought some to use for whitening the wig which he was going to wear to court. Suddenly it occurred to him that he might try this powder in making pottery. He did so, and was successful in obtaining porcelain. The white powder was china clay, and the treasured secret of the Chinese had been discovered!

In the making of porcelain it is necessary to use a mixture of china clays and mineral substances that will melt and bind the mass together in the firing. What Böttger discovered was not the real china clay, for that had long been used in Europe, but the trick of mixing raw materials in the necessary proportions. Heretofore it had not occurred to potters that translucence could be obtained through any medium except the artificial product, glass. It was not because the ware of glass composition was inferior to true porcelain that its manufacture was abandoned, but because its production was so uncertain. If in the firing the heat was too great, the glass melted and the contents of the oven became a shapeless mass.

English porcelain

In a short essay issued in 1716 we are told that the English were then making chinaware "as good as ever was brought from India."* The writer proceeds to explain, however, that the process of manufacture consists in grinding up broken fragments of oriental porcelain and molding them over. Between 1745 and 1755 several porcelain factories sprang up one after another, at Chelsea, Bow, Derby, and Worcester. The ware made seems to have contained much glass, and its sudden appearance would tend to indicate that the secret of manufacture had been imported from France.

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*Because porcelain was imported by the Dutch and English East India Companies, it was often referred to as coming from India.

Shortly before 1768 both china clay and china stone were discovered in Cornwall, and from 1768 to 1781 a true porcelain, resembling the Chinese ware, was produced at Plymouth and at Bristol. Experiments with bone ash were also successful, and the manufacture of bone porcelain became firmly established. From the beginning of the nineteenth century many new types appeared. A ware called Parian china, of fine grade and usually left without the glaze, became popular for odd dishes. A porcelain known as Belleek, or eggshell, ware, of great thinness, light weight, and covered with a pearly glaze, was manufactured in Ireland.

In America the porcelain industry has never been properly esteemed until very recently. William E. Tucker, of Philadelphia, was the first manufacturer to produce hard porcelain successfully; this was in 1825. In 1846 the manufacture of parian ware was introduced at Bennington, Vermont, and Belleek, or eggshell, porcelain was first made in this country in 1884. Porcelain industries have been established in many cities, and, while their work has been imitative rather than inventive, it has nevertheless been very creditable. The demand for foreign-made wares was sufficient to discourage any serious attempt that might have been made to invent new porcelains. A lack of knowledge on the part of the public that the best pottery and porcelain can be purchased at home has resulted in the decreased consumption of home manufactures and a large increase of imported goods. In order to foster home manufactures every important city should have its exchange where the best wares from all sections of the country could be gathered together for examination and comparison.

* * * * * *

In our present day and age we know that half the worth of living is in fully enjoying the things about us, and in having things about us that we can enjoy. Every home-maker creates an atmosphere in her home and sets a standard for the family when she selects her table furnishings. The graceful shape or the artistic design of the dinner dishes is insensibly felt and appreciated by the diners. Moreover, its charm is not lost on the home-maker herself as she arranges her table or puts the dishes away, and duty and pleasure thus go hand in hand. To have come to such a realization indicates how full of development, not how crude, the past has been. Our present-day comfort and enjoyment are the result of hard experience and vigorous activity on the part of generations that have gone before. We owe most, in a sense we owe all, of our present to the past, a past which began in the Old Stone Age; and a consciousness of this should arouse in us the feeling of an obligation to future generations. The strength of our desire to improve will be manifest in the refinement and grace of our table appointments, as in all things else that surround us.

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SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

W. A. STOCKING, JR., *Acting Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 51 NOVEMBER 1, 1913 **RURAL LIFE SERIES No. 4**

A STORY OF CERTAIN TABLE FURNISHINGS

DISCUSSION PAPER

Historical study impresses the reader with the fact that improvement has come about through conscious effort on the part of those who desire to advance. As generations of the past have done much for the present, so the present generation can do much for the future. Those who receive the Reading-Course Lessons for the Farm Home may be able to arouse the women of their communities to an interest in pleasing table appointments. A measure of success invariably follows a sincere effort to improve.

1. The Department of Home Economics is interested in gathering information concerning heirlooms that are to be found in New York State homes and will be glad to make a collection of photographs of such relics. Have you any photographs that you are willing to contribute?

2. Wherein are relics valuable as an aid to the study of history?

3. Why is it desirable to have durable china of attractive design on the family dining table?

4. Would the women in your community be interested in making a special study of desirable table appointments?

Name..............................

Address..............................

Date........................

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VOL. III. No. 53 DECEMBER 1, 1913 **RURAL LIFE SERIES No. 5**

THE CHRISTMAS FESTIVAL

BERTHA BETTS

Let's dance and sing, and make good cheer,
For Christmas comes but once a year!

Christmas means to us the anniversary of the birth of the Christ child. The beautiful story of his coming makes Christmas the most sacred of all days in the year. It is a season of common sympathy and general hospitality, of love, charity, and other best impulses of the human heart. In the words of Washington Irving, it is " the season for gathering together of family connections, and drawing closer, again, those bands of kindred hearts,

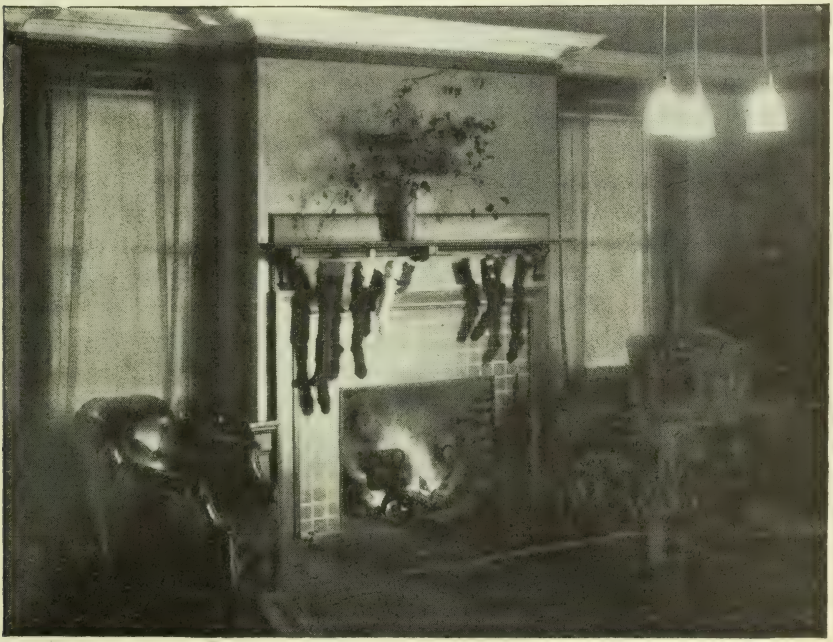


FIG. 56.—"*The stockings were hung by the chimney with care*"

which the cares and pleasures and sorrows of the world are continually operating to cast loose; of calling back the children of a family, who have launched forth in life, and wandered widely asunder, once more to assemble about the paternal hearth, that rallying-place of the affections, there to grow young and loving again among the endearing mementos of childhood."

The multitude of traditions and customs that have descended to us from the past have been the means of developing the spirit of Christmas and of endearing the Christmas season to the hearts of all people. Among many nations of ancient and modern times, this period of the year seems to have been recognized as a season of rejoicing. It marks the turning point of the year and gives promise of renewed light and warmth by the return march of the sun. The Roman Saturnalia, a season of festivity and rejoicing, fell at this time. Not only the spirit of the festival, but also many of its manifestations, became a part of the Christmas rejoicing of later days; hymns in honor of Saturn were the Roman forerunners of our Christmas carols; presents were exchanged between friends as they are to-day; dwellings as well as public places were lavishly decorated with greens. At the Roman festival, which lasted for several days, a ruler, or king, of sports was appointed to preside over the revelries.

At about the same period of the year the northern nations of ancient Europe held a festival in honor of the god Thor. It was characterized by song, dance, and feast, intermingled with the savage rites of religion, and was called Yule, Jule, or Iol.

Almost from the birth of Christianity the season of the Nativity seems to have been kept as a season of joy and thanksgiving. Naturally all the practices of pagan rejoicing were adopted as a means of honoring the new anniversary. Various writers tell us that throughout the Middle Ages the observance of the holiday (holy day) was celebrated by the whole state. From the palace of the king to the meanest hut of the peasant, merriment ran riot; all but the cooks kept holiday. Accounts of those times dwell on the prominent share which eating had in the festivities of the season:

> Now all our neighbors' chimneys smoke
> And Christmas blocks are burning,
> Their ovens they with bak't meats choke
> And all their spits are turning.

It is a great wonder that turkeys and geese did not become extinct before our time!

In England preparations for the festival seem to have been most costly during the twelfth and thirteenth centuries. Dramatic entertainments, in which king, queen, and court often took part, became popular. A special director called by various titles, such as "Lord of Misrule," "Master of the

Revels," "Christmas Prince," was appointed to manage these court revels. The length of time over which his sway extended is not accurately defined, or it may have varied with circumstances; probably it extended from Christmas to Twelfth-night. In English literature there is frequent mention of the twelve days of Christmas.

In the seventeenth century a blow was struck against such festivities by the passing of certain ordinances, in London, suppressing plays and other diversions. It is said that the Puritans labored long in order to prove that the celebration of the Nativity was idolatrous and that the ceremonials were of pagan origin. In various places this Puritanical influence so far prevailed that the decking of churches and the holding of divine service in them was forbidden. For years the struggle against the celebration of Christmas went on. Since then the stately form of its celebration has gradually passed away, but the festival never will become extinct.

Some of the fooleries of the past ages could not be proposed as worthy amusements; but among pagan and Christian festivities there are many which are worth while considering, certain of them so beautiful in their significance that their loss would be irreparable.

CHRISTMAS GIFTS

Not what we give, but what we share,
For the gift without the giver is bare.

One of the modern abuses of the Christmas spirit is the promiscuous giving of presents, which has become almost a national grievance. Does our Christmas giving symbolize the Christmas spirit? Does it not spoil the whole season for many of us, as well as for our families? In many localities, giving has developed into a rivalry involving a sacrifice of time, strength, health, and happiness. What can be substituted for presents? The giver can give herself, her normal, healthy, happy self, unwasted by a strenuous period of gift preparation and the giving of soulless gifts. Why not send:

My love to all those that I love,
My love to all those that love me,
My love to all those that love those that I love
And those that love those that love me.

The memory of a "Happy Christmas" will remain long after the remembrance of the possible gift will have faded into oblivion.

The simple home gifts may be modest and yet be more treasured than gold. The rag doll is just as well loved as the silk-robed beauty, if not better; and is it not more valuable to the child? Love can be lavished on it without fear of spoiling its finery. The childish imagination will invest it with beauties and perfections that money cannot possibly buy.

SANTA CLAUS

In a book entitled "Is there a Santa Claus?" Jacob Riis says: "Santa Claus is the spirit of Christmas, and ever and ever so many years ago when the dear little baby was born after whom we call Christmas, and was cradled in a manger out in the stable because there was not room in the inn, the Spirit came into the world to soften the hearts of men and make them love one another. Therefore, that is the mark of the spirit to this day. Don't let anybody or anything rub it out; the rest doesn't matter." At first the Christ child was the dominant figure in Christmas giving. He was declared to reward obedient children who loved their parents. In Germany the name used was Krist Kindlein. Gradually the personality of the Christ child, as a giver of physical gifts, became fainter and fainter, and the name was corrupted into Kriss Kringle, a being finally identified with Santa Claus. St. Nicholas, who was a Greek, died about 343 A. D. He was considered the patron of children and the good genius of the gift season. There are various interesting legends about him.

At the present time the names Santa Claus and St. Nicholas are used almost synonymously. In our childhood all of us have heard the legend of how on Christmas Eve St. Nicholas, or Santa Claus, driven by his swift reindeer, comes to our dwellings, climbs down the chimney, and from out his plentiful pack fills the family stockings, which hang at the chimney piece, with good things.

'Twas the night before Christmas, and all through the house
Not a creature was stirring, not even a mouse.
The stockings were hung by the chimney with care,
In hopes that St. Nicholas soon would be there.

The custom of hanging up stockings to receive Christmas gifts was brought to this country by the Pilgrim Fathers, and is supposed to have originated in the north of England. It adds a pretty touch of mystery to our legitimate family-Christmas-giving.

THE CHRISTMAS TREE

The whole world is a Christmas tree,
And stars its many candles be.

From earliest times the tree has been an object of worship, common to all races. The Christmas tree, however, which is at present so essential a part of the festivities, is thought to be of very recent origin. It is said to have originated in Germany and was introduced into England in the reign of Queen Victoria. Since its introduction the custom has spread with marvelous rapidity throughout the world. Just how the decorated tree became associated with Christmas is not definitely known. In the Middle Ages there were certain trees which were believed to blossom and bear fruit at Christmas. The ancient church devoted the day before Christmas to the memory of Adam and Eve, and in many parts of the Continent it was customary to give dramatic representations of the Creation, as well as of the Nativity, in which trees, or a single tree, were decked with apples and ribbons. In parts of ancient Germany various kinds of branches were placed in pots of water or in moist earth early enough in the season so that they would bloom at Christmas. Indeed there was much rivalry between families to see which could show the most flourishing branch.

At first the Christmas tree was not illuminated. By some persons the origin of wax tapers is traced to the Roman Saturnalia, at which it was customary to give lighted candles as presents. The candles were regarded as symbolical of the new birth of the sun, which typified the renewal of life. The Christmas tree itself has sometimes been called the " Universe-tree," with the lights of heaven for its fruits, and its branches covering the world.

Although our modern Christmas tree is attractive and beautiful, do we need it? Countless millions of sturdy little evergreens are each year felled by the woodsman's relentless axe because, for a single day, we desire a Christmas tree — one that can never blossom again! Is not the German custom of planting branches a more rational one? Almost any kind of branch can be made to grow and blossom forth, and such experiences are certain to add interest and joy to the Christmas season. Branches of willow and hazel trees afford excellent material on which to begin. Why not use the new kind of tree this Christmas?

If the Christmas tree is not to be denied, cannot a perpetual one be planted in a tub and be made to bloom annually, appearing more lovely each holiday season than it was the year before? Could it not be made quite as beautiful and infinitely more safe if candles were omitted from its branches?

CHRISTMAS DECORATIONS

Lo! now is come our joyfull'st feast.
  Let every man be jolly.
Each room with ivie now is drest
  And every post with holly.

One of the most unfailing indications of the season is the adorning of our houses and churches with evergreens, which are gathered from the winter gardens of hedges and forest. The use of such decorations is a manifestation of rejoicing and worship that has existed from earliest days among pagans and Christians alike. At the present day the plant most symbolic of Christmas festivities is the holly, probably because

FIG. 57.—*The family tree at its annual blossoming time*

of its glossy green leaves and vivid red berries. Closely associated with it is the mystic mistletoe, which has been an object of veneration for centuries and which was especially sacred to the druids. Medicinal properties were ascribed to it and it was supposed to drive away evil spirits. If, at Christmastide, a branch of mistletoe is suspended from the ceiling or over a doorway, the maiden who is kissed under it will be married within the coming year. Some authorities assert that a berry must be picked off with each kiss and that the privilege ceases when all the berries are gone. The laurel was considered by the Romans as the emblem of peace, victory, and joy. The relation of its symbolism to the Christmas season is obvious. Sometimes branches of it were flung on the Christmas fire by those who sought for omens in its curling, crackling leaves. The ivy was used largely for outdoor decoration. The rosemary was used probably for its fragrance, although it was supposed to possess many occult virtues, such as " to clear the head, strengthen the memory, and make appeal to the heart." In fact, whatever green thing the world afforded was used. At the present day, the vivid colors of many flowers that were unknown to our ancestors add to the gaiety of the decorations. The red poinsettia has grown to be almost as symbolical of the Christmas season as the holly is.

Decorations for the Christmas season are indispensable, and best of all they are within the reach of every one. The children will be glad to look for and help gather them. The forests, the fields, and even the dooryards are full of green things. The evergreen trees will gladly spare us a few of their glossy branches. The ground pine can be found just beneath its coverlid of snow. Its twining stems make beautiful wreaths in response to the guidance of inexperienced and tiny hands. In many sections laurel is abundant, and it lends itself easily to house and church decoration. All green plants, even to the tiniest of the mosses, are useful. If a lining of earth covered with a layer of soft gray-green moss is placed in a shallow dish and a few sprigs of wintergreen, with their saucy red berries, are planted in it, a lovely little Christmas garden will result, which, if watered carefully, will last for several weeks after other decorations are faded and gone.

THE YULE LOG

By the primitive church, Christmas was observed like the Sabbath day, and for that reason there arose the custom of keeping vigil on the night before Christmas, whence came the name " Christmas Eve." The " yule log," or " Christmas block," was used to furnish illumination for the watchers. The log was brought into the house with great ceremony, laid on the hearth, which was usually in the center of the room, and lighted with a brand that had been saved from the log of the previous year. Often music was played during the ceremony of lighting. The log was deemed a protection against evil spirits, but "its virtues were not to be extracted unless it was lighted with clean hands." Around this fire the vigil of the evening was kept by song, tale, and jest. If the log burned out during the night it was considered an evil omen. On the evening before Christmas this pretty custom would be quite possible for those who are fortunate enough to possess a fireplace. Pop corn, roasted apples, nuts, and cider would be delightfully appropriate refreshments.

CHRISTMAS DISHES

Little Jack Horner
Sat in a corner
Eating his Christmas Pie.
He put in his thumb,
And pulled out a plum,
And said, "What a big boy am I."

This is the season for pies. Pies of all sizes and shapes, with all kinds and conditions of fillings, are mentioned in nearly every record of Christmas. The most characteristic Christmas pie was certainly the ancestor of our present mince pie. In an article written in the seventeenth century there is a description of a dish that corresponds closely to our modern pie. The composition of the dish is described as follows: "In every family they make at Christmas a famous pie which they call a Christmas pie. The making of this is a great science; it is a learned medley of neat's tongue, the brawn of a chicken, eggs, sugar, currants, citron and orange peel, various sorts of spice . . ." In the north of England "the giblets of a goose, boiled and finely chopped, were used instead of beef."

The Christmas pie

(An old English recipe)

Mincemeat

4 pounds raisins
4 pounds currants
4 pounds apples, chopped
6 pounds suet
½ fresh ox tongue, boiled and chopped
½ pound candied orange peel, cut fine
½ pound candied lemon peel, cut fine
¼ pound candied citron
Juice of 3 oranges and of 3 lemons
Grated rind of 2 lemons
1 quart cider, boiled
1 nutmeg, grated

1 teaspoon cinnamon
1 tablespoon salt
½ pound sugar may be added if very sweet mincemeat is desired
Mix thoroughly and cook until done. Add more cider to the mixture when making the pies.

The Christmas pudding

(This is a distinctively English dish)

Plum pudding

1 pound currants
1 pound raisins
1 pound suet
1 pound bread crumbs
½ cup grape juice or cider
1 teaspoon cinnamon
1 teaspoon cloves
1 teaspoon allspice
1 pound sugar
½ pound citron
½ cup flour
5 eggs
½ nutmeg
Nuts if desired

Mix thoroughly. Place in greased tin cans (one-pound baking-powder cans may be used). Fill the cans two thirds full. A greased cloth may be used in place of the cans if desired. Set the pudding on an inverted saucer in a kettle of water, and boil all day, or longer if possible. If boiled the second day remove the pudding from the water and leave it tied in a cloth over night.

Foamy sauce

½ cup butter
1 cup powdered sugar
1 egg
½ teaspoon vanilla or wine

Cream butter, gradually add sugar, an egg well-beaten, and vanilla; beat while heating over hot water.

Round puddings are often served on a large dish surrounded by a wreath of holly. A small hole is scooped out at the top, into which a large thimbleful of alcohol is poured; the alcohol is then lighted, and the pudding, with flaming top, is triumphantly brought to the table.

Christmas candies

Fondant

2 cups sugar in 1 cup water
⅛ teaspoon cream of tartar

Stir over heat until melted. Cover, and boil covered for several minutes. Remove the cover and boil without stirring to 114° C. or 238° F. If a thermometer is not procurable, the soft-ball test may be used. The soft-ball stage is determined by pouring a bit of the boiling sirup into a cup of very cold water. The sirup should be thick enough to form a ball which is fairly firm under water, but which flattens and softens between the fingers when removed from water. While boiling, wash down the sides of the pan with a wet swab in order to remove any crystals that form on the sides of the pan above the sirup line. A piece of cheesecloth wrapped tightly around a small piece of wood makes a good swab. Do not agitate nor stir the sirup after it has begun to boil. When cool, beat with a spoon to a soft, creamy mass; remove from the sauce-pan and mold with the hands. The fondant may be kept for some time in a covered earthen vessel or a covered glass jar.

Coffee fondant can be made by using coffee instead of water.

For maple fondant use brown sugar instead of granulated; omit the cream of tartar, and boil to a slightly higher temperature.

Candies made with fondant

Fondant creams.— Melt plain fondant in a double boiler. Add a few drops of flavoring, such as oil of peppermint, wintergreen, or cinnamon; then drop from a teaspoon upon waxed paper. One must work quickly, as the creams stiffen almost immediately.

Fondant bars.— Melt any flavor of fondant as above. To the melted fondant add chopped or broken nuts, cherries, or figs. Pour into a pan; when stiff cut into bars.

Molasses taffy

2 cups molasses
1 cup sugar
3 tablespoons butter
¼ teaspoon soda

Boil to 122° C. or 252° F., or the hard-ball stage. Pour into shallow pans or plates in order to cool. When cool enough to handle, pull until it is as light-colored as desired. Draw out into sticks and cut into lengths.

Pop corn balls

The sirup of molasses taffy should be cooked until, if dropped into cold water, it will crack between the fingers and will not adhere to the teeth. Use just enough sirup to hold the pop corn together; work up into balls quickly.

CAROLS

Oh, sing a carol joyfully;
The year's great feast is keeping.

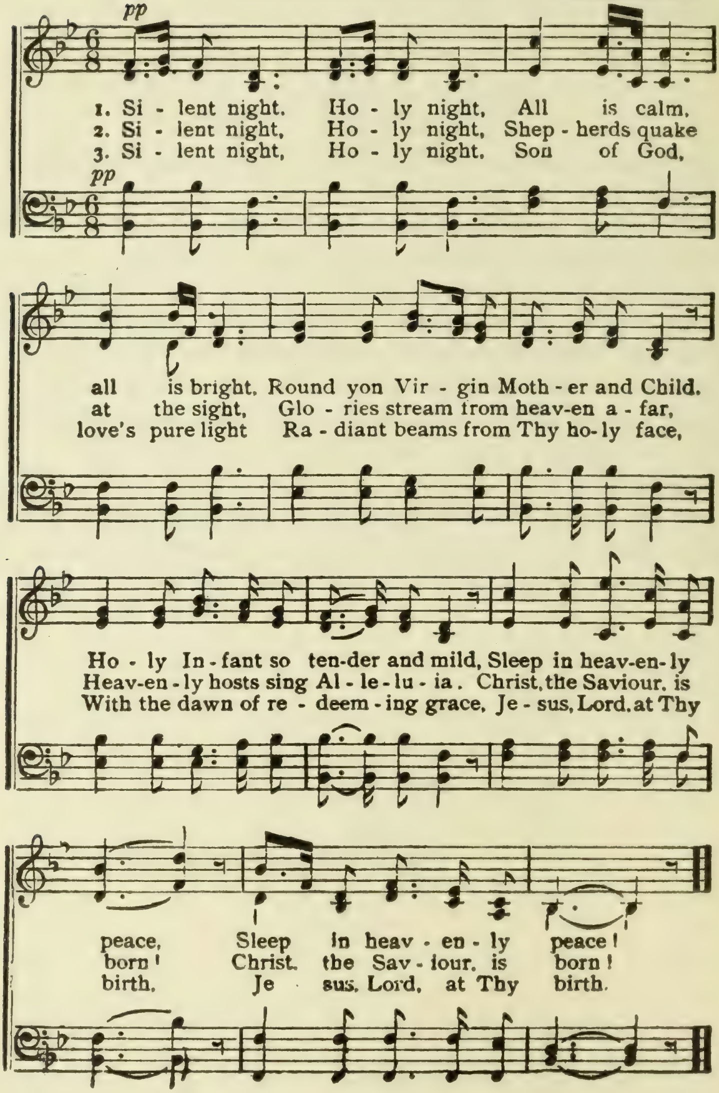
The carol is in its truest sense a joy song. Through the carol the Nativity was hailed with music in commemoration of the songs of the angels. For several nights preceding Christmas, the singers used to assemble in groups, pass from door to door, and fill the still, cold night air with their music. In many towns the custom is being revived. Singing societies go about on Christmas Eve, singing at various places in the town so that all may hear. Those who have never heard the Christmas caroling cannot appreciate its beauty and dignity. The crude carols of early days have been replaced to-day by modern carols and anthems, which even more thoroughly express the spirit of the season, "Peace on earth, good will toward men."

May not this pretty custom be adopted inside the home as well as out of doors? There are many beautiful songs appropriate to the season which are familar to all, and many new songs which we should be glad to learn.

Silent Night

CHRISTMAS CAROL

MICHAEL HAYDN


pp
1. Si - lent night. Ho - ly night, All is calm, all is bright. Round yon Vir - gin Moth - er and Child. Ho - ly In - fant so ten-der and mild, Sleep in heav-en-ly peace, Sleep in heav - en - ly peace!
2. Si - lent night, Ho - ly night, Shep - herds quake at the sight, Glo - ries stream from heav-en a - far, Heav-en - ly hosts sing Al - le - lu - ia. Christ, the Saviour, is born! Christ, the Sav - iour, is born!
3. Si - lent night, Ho - ly night, Son of God, love's pure light Ra - diant beams from Thy ho - ly face, With the dawn of re - deem - ing grace, Je - sus, Lord, at Thy birth, Je - sus, Lord, at Thy birth.
pp

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

W. A. STOCKING, JR., *Acting Director* A. R. MANN, *Editor*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 53 DECEMBER, 1913 **RURAL LIFE SERIES No. 5**

THE CHRISTMAS FESTIVAL

DISCUSSION PAPER

This discussion paper may be returned with answers to the questions and with any suggestions of your own. While the answering of these questions is not absolutely necessary, much greater benefit will be derived if you share with others your own experience. It will also help us to understand your point of view. The lesson may be used in the grange and in the club where these subjects are considered.

1. How can you help to change the present gift competition into the real Christmas spirit?

2. What Christmas custom is dearest to you and to the members of your family?

3. What special Christmas dishes do you prepare?

Name..

Address.......................................

Date..............................

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VOL. III. No. 55 JANUARY 1, 1914 **FOOD SERIES No. 8**

RICE AND RICE COOKERY

Miriam Birdseye

RICE deserves to be better appreciated and more commonly used in northern homes. In the southern States, where it has been cultivated since early colonial times, it holds the same secure place in the dietary that the potato justly enjoys in our own section. In countries where rice grows — and their population totals more than half of that of the entire globe — it forms the mainstay of the diet of rich and poor alike. In a certain part of the world persons greeting each other on the street do not say, " I hope I see you well," but " May you have plenty of rice to-day." Our own custom of showering the departing bride and groom with rice is probably of Chinese origin, for in China rice is the symbol of prosperity.

The home-maker is coming to see more and more clearly how important a part of her problem lies in the proper selection of food. She is no longer content to limit her inquiries to first cost of food and to wholesome and appetizing methods of food preparation. This information is just as necessary now as it has ever been, but the woman alive to her responsibility makes a still deeper study. " What does this food contribute to the real food needs of my family? " she asks. " How does it compare in cost with other foods which render essentially the same service? "

Even the rice enthusiast is constantly discovering new and interesting ways of using it; and the housewife who knows it only as a formless, pasty mass which must be smothered in gravy in order to be eatable, as well as she who associates it chiefly with the justly famous rice pudding, will profit by closer acquaintance with a grain that appears with equal distinction in the roles of invalid drink, cereal, dinner vegetable, soup, salad, and made-over dish.

RICE PLANTS AND THE RICE FIELD

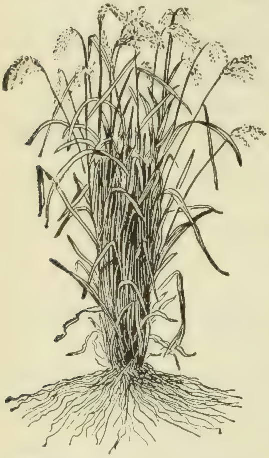

FIG. 58. — *A rice plant**

In tropical and subtropical climates, wherever the water supply is abundant and easily controlled, rice is an important crop. Like other cereals, it is a member of the grass family. In appearance it resembles oats or wheat, although its leaves are narrower and its stalks are more slender. A single seed sends up a large number of shoots, or culms, so that a rice plant forms a dense clump of slender waving stems five to six feet high, crowned with tassel-like fruiting heads (Fig. 58). Almost any variety of rice can be grown on dry land, but upland rice, as it is called, is never so thrifty nor of so fine a quality as that grown under irrigation. In Eastern countries irrigation is often accomplished by flooding the rice fields at a tremendous cost of human energy. Day in, day out, along the banks of the Nile and the rivers of India and China, during the months when the growing grain must be constantly supplied with water, the mournful creaking of the water wheel is heard. Propelled by the patient water buffalo, or by no less patient human animals, it slowly raises the precious liquid from the turbid stream and pours it into channels which feed the greedy fields. In comparison with the methods of irrigation employed in Eastern countries, our own methods seem marvels of ease and convenience.

RICE-GROWING SECTIONS OF THE UNITED STATES

In the United States, there are three distinct sections where rice-growing is an important industry. Each of the three sections has its own characteristic land formation and a system of cultivation and irrigation adapted to it.

The Carolinas and Georgia. — In the low-lying delta lands and the marshes of the tidewater region of Georgia and the Carolinas the rice-growing industry became firmly established in early colonial times. The rice fields are situated far enough inland to be above the flow of salt water, but by means of dikes they can be flooded at high tide and drained at low tide. The principal varieties raised are the famous "gold seed" rice, noted for its deep orange husk, its long kernel, and its wonderful yield, and a long-kerneled, white-husked variety. Until the close of the Civil War, these three South Atlantic States continued to furnish all the rice that found its way to northern markets and to foreign ports. To-day, because of the expense of cultivating and harvesting the crop by hand, since the soil is so moist that modern harvesting machinery cannot be used, scarcely enough genuine Carolina rice is raised to supply local needs and very little finds its way into northern markets.

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*From Hunt's "Cereals of America," published by the Orange Judd Company.

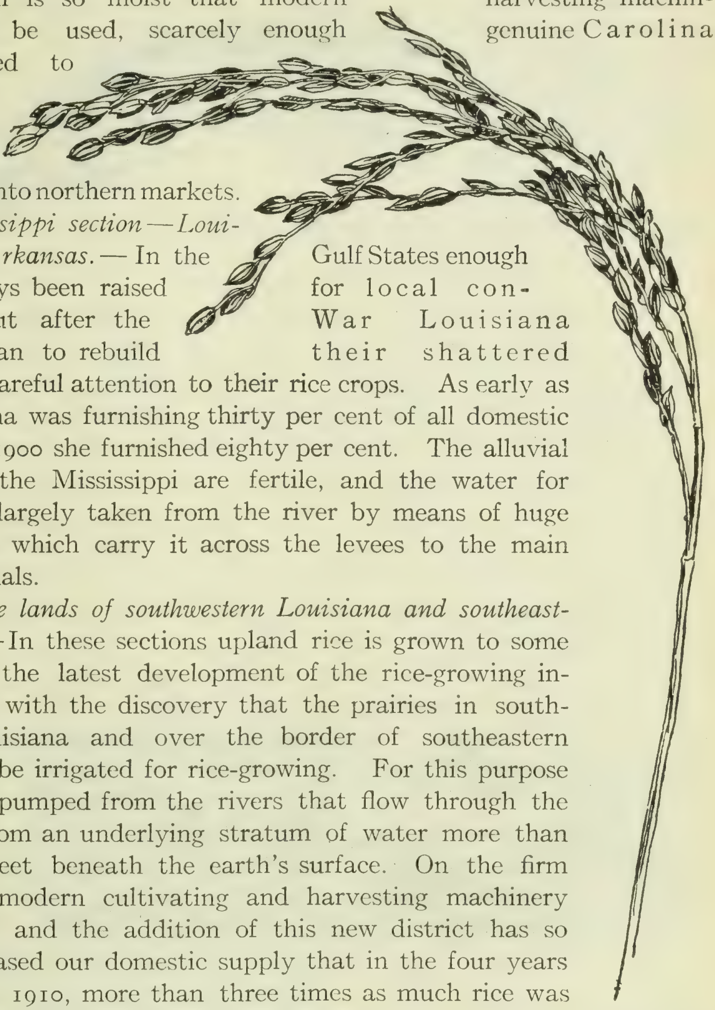
Fig. 59.—*Gold seed, or Carolina rice*

The Mississippi section — Louisiana and Arkansas. — In the Gulf States enough rice had always been raised for local consumption, but after the War Louisiana planters began to rebuild their shattered fortunes by careful attention to their rice crops. As early as 1875 Louisiana was furnishing thirty per cent of all domestic rice, and in 1900 she furnished eighty per cent. The alluvial lands along the Mississippi are fertile, and the water for irrigation is largely taken from the river by means of huge siphon pipes which carry it across the levees to the main irrigating canals.

The prairie lands of southwestern Louisiana and southeastern Texas.— In these sections upland rice is grown to some extent, but the latest development of the rice-growing industry came with the discovery that the prairies in southwestern Louisiana and over the border of southeastern Texas could be irrigated for rice-growing. For this purpose the water is pumped from the rivers that flow through the section, or from an underlying stratum of water more than a hundred feet beneath the earth's surface. On the firm prairie soil modern cultivating and harvesting machinery can be used, and the addition of this new district has so greatly increased our domestic supply that in the four years from 1906 to 1910, more than three times as much rice was raised as in the four years from 1896 to 1900.

In the Mississippi and the prairie sections two distinct types of rice are raised. These are (1) a long white-husked grain originally imported from Honduras, and (2) various newly domesticated varieties recently obtained from Japan. The Japanese rice has shorter, rounder kernels than either the Carolina or the Honduras varieties, it is more prolific and more easily cultivated, and mills a large percentage of unbroken grains. For this reason it is being extensively grown, but the smaller cost of production and the larger supply of the Japan type, combined with the curious disfavor in which the housekeeper still holds its short, fat kernel, have operated to keep the price of this type through all market fluctuations at least a cent a pound lower than that of Honduras type of equal grade.

LABELING OF DOMESTIC RICES

A recent pure-food ruling* requires that, in the labeling of rices, geographical names indicating the origin of the variety may continue to be used, provided these names are accompanied on the label by a plain statement of the locality where the rice was actually grown, as for example: Japan rice, grown in the United States; Honduras rice, grown in Louisiana; Carolina rice, grown in Arkansas. It was ruled, however, that the trade names, "Carolina White" and "Carolina Gold," had become so firmly established that they might, without further qualifications, be applied to rices of the long-kerneled Carolina varieties, no matter where they were grown. This decision, and the practice, which had obtained up to its issuing, of

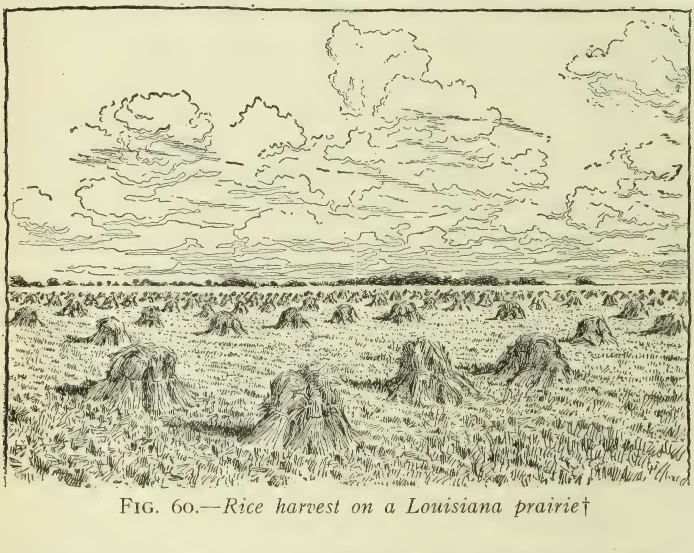

FIG. 60.—*Rice harvest on a Louisiana prairie*†

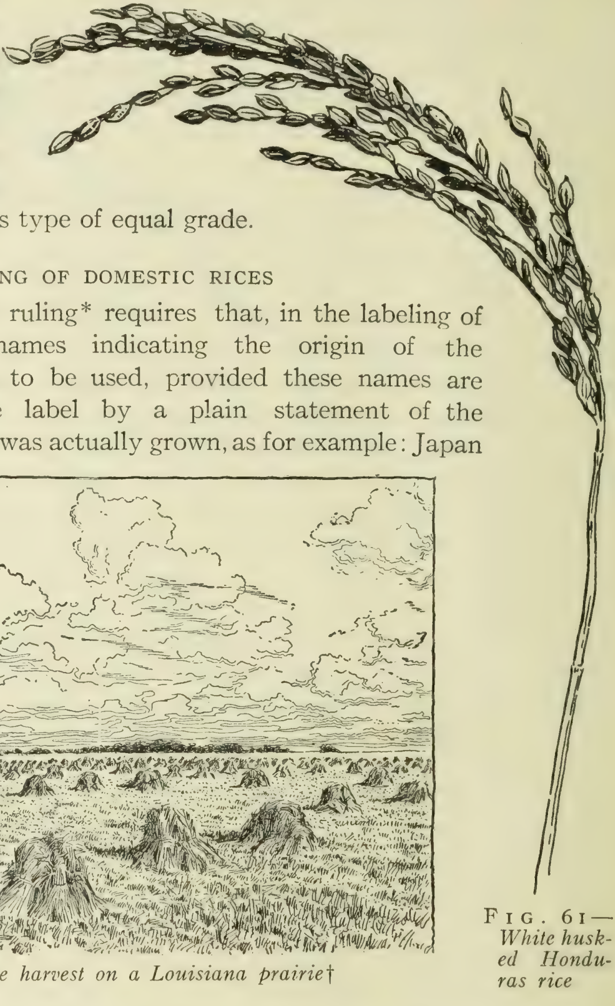

FIG. 61—*White husked Honduras rice*

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*Food Inspection Decision No. 123, issued June 16, 1910.

†From the "Cyclopedia of American Agriculture," published by The Macmillan Company.

labeling any long-kerneled rice Carolina rice, accounts for the large quantity of so-called Genuine Carolina still in the market. It is probable that as the retail dealer becomes more familiar with the altered conditions, more will be heard of Honduras rice and less of Carolina.

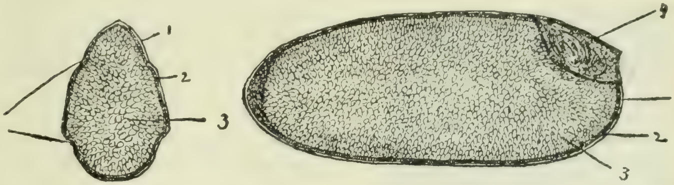

FIG. 62.—*Longitudinal and cross sections of a rice kernel: (1) bran coat; (2) aleurone layer, containing valuable mineral salts; (3) cells packed with starch grains; (4) germ, containing fat and mineral matter**

RAISING A RICE CROP

To those who are familiar with the cultivation of other cereals, the raising of a crop of rice will seem a strenuous achievement. Fields must be graded and canals and dikes must be built in order to distribute the water evenly to the desired depth; for if water stands deeper in some parts of the field than in others, the crop ripens unevenly. In many sections, huge pumping plants must be installed in order to deliver the water to the main feed channels. Just before or just after planting, the ground must be carefully flooded, and a few days later the water must be entirely drawn off so as to allow the seed to germinate. In the East, seed is sown in specially prepared beds and is transplanted by hand. At the end of one or two months, when the young plants have reached a height of six to ten inches, the ground is again flooded and the water must now be kept at a depth of three to twelve inches for six or seven weeks; it is finally withdrawn in order to allow the grain to ripen and to enable the ground to dry off before harvesting. During this long flooded period, the water must be drawn off and renewed at least once a week, in order to prevent stagnation and to keep the water weeds that drift in with the current from taking root. These water weeds are a serious menace to the growing crop; but what the planter dreads even more is

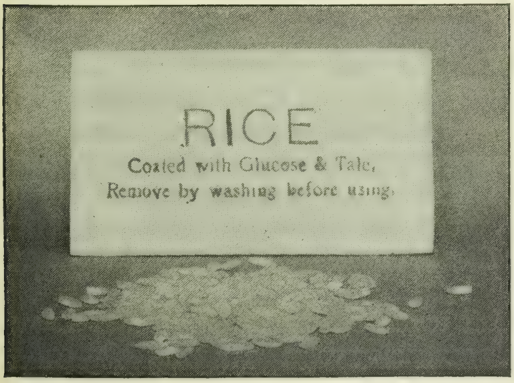

FIG. 63.—*Pure food regulations require the dealer to label coated rice*

the appearance of the so-called red rice, a kind of disreputable relative of the true rice which after milling shows a single fine red line lengthwise of the kernel. This vagabond is very prolific, crosses freely with orthodox varieties, and greatly reduces the value of the crop. In second-quality rice we sometimes come across a few of these kernels. When the grain is in the milk, bobolinks, English sparrows, and other birds flock to the feast. In some sections it is even necessary to employ men, known as bird-minders, to drive away the invaders.

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*From Hunt's "Cereals in America," published by the Orange Judd Company.

Finally, about six months after planting, the grain is ripe. It must then be carefully dried out and guarded constantly against fermentation under the hot sun, before it can be threshed.

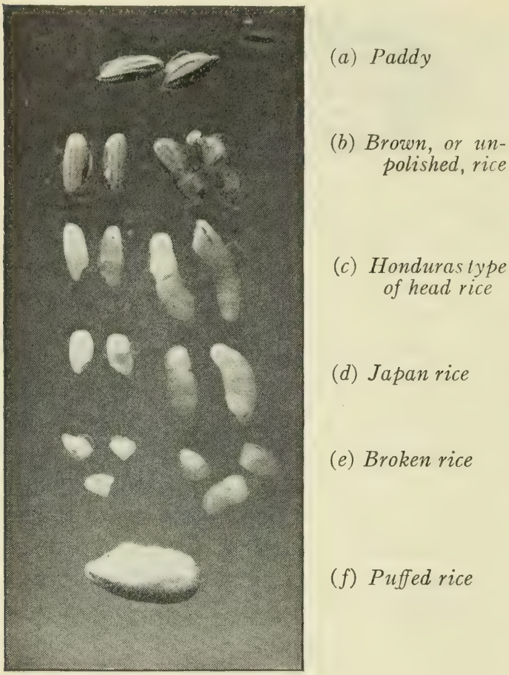
(a) Paddy
(b) Brown, or unpolished, rice
(c) Honduras type of head rice
(d) Japan rice
(e) Broken rice
(f) Puffed rice

FIG. 64.—*Varieties of rice*

THE MILLING OF RICE — PROCESSES AND PRODUCTS

When the threshed rice reaches the mill, it is known as rough rice, or paddy. The first process of milling removes the outer husk, which is so strongly impregnated with silica crystals that it cannot be fed to stock but is used only for fuel or packing. The bran is next removed and with it comes a large part of the germ, which bulges out a bit at one end of the kernel and so is easily broken. Rice bran makes a satisfactory feed unless it is allowed to become rancid.

Unpolished rice.— We have left unpolished rice, which still retains a thin layer of tough aleurone cells containing valuable mineral salts, and a part of the broken germ with its fat (Fig. 64). The kernel is now a pale gray-brown.

Polished rice.— Fashions in foods are sometimes as unreasonable as fashions in frocks. Until a year or so ago, unpolished rice was not considered sufficiently elegant for American tables and even to-day few housewives use it, desirable as it is. The third milling process, known as polishing, carefully removes the germ and the aleurone cells and with them most of the flavor and the invaluable mineral salts. In Fig. 64 is shown the nick, or " bite," at one end of the kernel, where the germ used to be. The refined product is comparable to white flour in that it lacks the tonic qualities and the flavor of the whole grain product. The scourings, known as *polish*, sold abroad for human consumption and at home for feeding pigs and dairy cattle, contain nearly twice as much food-value per pound as the best head rice and sell for about one quarter the price. The denuded grains have the familiar filmy-white appearance, but they are not shiny.

Coated rice.— In order to obtain the much coveted shine, the polished rice may now receive a coating of glucose and talc in the proportion of one part of glucose and three parts of talc to a thousand parts of rice. It is claimed that this hard, smooth covering lessens friction in handling and prevents fermentation and attacks by insects. The U. S. Government publication, Food Inspection Decision No. 67, issued in April, 1907, directs that coated rice shall be labeled in all cases with the name of the extraneous substances. In Fig. 63 is shown such a label bearing the words, "Coated with glucose and talc." Glucose is a harmless substance and dissolves readily enough in cold water, setting the talc free; but the increasing demand for uncoated rice and the readiness of dealers to handle it at the same price as the coated article, show not only that we are gradually learning to discriminate against adulterated goods, but that the adulteration in this case is unnecessary. Dealers sometimes confuse the terms " coating " and " polishing," and when one asks for unpolished rice one is frequently offered the polished, but uncoated, kind.

Head rice and broken rice.— After the grains have been polished, they must be graded. Rice is exceedingly brittle, and a large percentage of the kernels are broken in the milling. The perfect kernels, assorted as to size, constitute the several grades of head rice; imperfect kernels are screened into the several grades of broken rice, the lowest of which is extensively used in brewing.

Brown, or natural, rice.—A couple of years ago, when the attention of the public first began to be called to the great loss of mineral salts in polishing, a leading wholesale dealer persuaded a reluctant manufacturer to prepare for him a few hundred pounds of unpolished rice. This he put on the market as brown, or natural, rice under his own brand; it was considered a great novelty. As housewives have gradually become infused with the back-to-the-whole-grain enthusiasm, the demand for unpolished rice has slowly gained headway and to-day many progressive retailers carry some one of the several brands now on the market. Owing to the presence of the aleurone layer, brown rice requires longer cooking than white requires. The characteristic flavor is due largely to the presence of the fragment of germ. In putting it up, only perfect grains of fine quality are used, and the large percentage of broken kernels must be sorted out and polished in order to avoid a serious loss. Brown rice is more easily attacked by insects than is white rice, and there is consequent risk in handling it during the summer months. For these reasons and because it is still rather a novelty, brown rice is sold only in one-pound packages and commands a fancy price. With an increased demand which would include some of the lower grades, it seems as if this valuable product could be put on the market at a much lower rate.

Varieties of rice illustrated.— In Fig. 64 are shown (a) two grains of rough, or paddy, rice as it reaches the mill; (b) brown, or unpolished, rice, retailing at twelve cents a pound; (c) a fancy grade of the Honduras type of head rice, at ten cents; (d) a second quality of the Japan type, at eight cents; (e) a fair quality of broken rice at six cents; and (f) a kernel of dainty puffed rice, which is no more nourishing than rice in cheaper form, but for which we pay the comparatively large price of forty cents a pound (6 ounces for fifteen cents). At the left, the grains (b), (c), (d), and (e) are shown as purchased; at the right, they are shown after they have been cooked by the rule for boiled rice given on page 1663. Prices are quoted so that the housewife may compare the various grades as they appear both on her table and in her account book. It will be noticed that, when properly prepared, the eight-cent rice can hardly be distinguished from the ten-cent grade. The skilful cook can even substitute broken rice in many dishes without sacrificing either appearance or flavor.

A WORD ABOUT FOOD VALUES

Food needs of the body.— Previous lessons for the Farm Home* discuss more fully than is here possible the food needs of the body. For our present purpose, it is sufficient to remind ourselves that the great bulk of our food each day should consist of energy-giving materials in the form of carbohydrates (starches and sugars) and fats; that we need also nitrogenous or protein food, whose main function is the building up and repairing of the body tissues, although it yields energy as well; and small, but appreciable, amounts of certain mineral elements, such as lime, phosphorus, iron, and potassium, which are built up into bone, muscle, and nerve, are found in all body fluids and play an important part in every vital process, although they yield no energy. In their natural state, foods are mixtures of varying proportions of the so-called foodstuffs together with water. In general, animal foods are rich in protein, which means that they are important in building cell-tissue; vegetable foods are espe-

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*The Cornell Reading-Course Lesson for the Farm Home, No. 29, Food Series No. 7.
The Cornell Reading-Course Lesson for the Farm Home, No. 43, Food Series No. 9.

cially rich in carbohydrates, which means that they are valuable sources of energy-yielding material. Many of the vegetable foods are rich in protein as well as in carbohydrates. Both animal and vegetable foods contain more or less fat, which is an energy-yielding foodstuff; they contain also varying quantities of mineral salts, which aid both in body-building and in body-regulating. As might be expected, the richest, most complete foods are those which, like milk and eggs in the animal kingdom and ripened seeds among plants, have been developed especially to nourish the young organism until it is able to shift for itself.

How foods are compared.— Since protein, carbohydrates, and fats have the common quality of yielding energy when consumed in the body, and since this energy is easily transformed into heat and is best measured in this form, this heat-giving property is one way of comparing food values. The unit of heat is the calorie; if we know how many calories or heat units to the pound each of two foods will yield and at the same time how much protein and mineral matter each contains, it is not difficult to determine which is the more economical as a source of energy. We must go further than this, however, and make the comparison include both the protein and the mineral values of the two foods, since the needs of the body include not only energy-yielding, but also building and regulating stuffs. A food may be cheap as a source of energy, but expensive as a source of either protein or mineral matter.

RICE AS A FOOD

Composition.—As a ripened seed, we expect to find rice essentially a carbohydrate, or energy-giving food, but well supplied at the same time with other foodstuffs. This is true of natural rice, although in comparison with wheat and oats it has a rather small amount of protein. It has already been explained how most of the mineral matter and fat are lost in the polishing process (Table 1)* so that white, or polished, rice is valuable chiefly for its starch, in which it is richer than many other cereals.

TABLE 1. COMPARISON BETWEEN POLISHED AND UNPOLISHED RICE

	Moisture	Crude fiber	Protein	Fat	Carbohydrates	Mineral matter
Unpolished, or brown	11.88	.93	8.02	1.96	76.05	1.15
Polished, or white	12.34	.40	7.18	0.26	79.36	0.46

Digestibility.— Grains of rice starch are so tiny and the walls of the plant cells which surround them are so delicate that rice is not only a very quickly cooked cereal, but it is also easily digested and completely utilized by the body. Rice water is commonly prescribed for persons suffering from diarrhoea and kindred inflammatory conditions of the intestines, where an energy food is needed which will put the minimum tax on the digestive organs; and well-cooked rice is recommended for convalescents and for young children.

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*Figures taken from page 272 of Leach's "Food Inspection and Analysis."

A valuable source of energy.— Rice is thus well fitted to take a place among our staple carbohydrate foods — those to which we turn as the most natural and the cheapest sources of the large amount of energy which our food must furnish each day. These staples are the breakfast cereals, bread and other flour products, potatoes, macaroni, and sugar in small quantities. In rice-growing countries large classes of people make rice the mainstay of their diet; it is their " staff of life," as wheat is ours.

One frequently hears the statement that when potatoes are high, it is cheaper to eat rice. Let us see how true this is. Potatoes have an average fuel value of 310 heat units per pound, while an equal weight of rice furnishes 1630 heat units. Therefore, it requires ten medium-sized potatoes, five and one quarter pounds, to give the same amount of energy as two cups or one pound of rice. When potatoes are a cent a pound or sixty cents a bushel, they cost only one half as much as rice at ten cents; ten-cent rice must therefore be considered a luxury. But when potatoes soar to a dollar a bushel, rice at eight cents a pound is slightly more economical as a source of energy than potatoes are; and to use six-cent rice means a clear saving of two and three quarter cents for every pound. It must be borne in mind, however, in favor of potatoes, that they contain large quantities of valuable salts, especially of phosphorus and potash, which are almost wholly lacking in polished rice. Therefore, rice should not be used to replace potatoes to any great extent, unless other succulent vegetables are used liberally.

Rice compared with other starchy foods on a cost basis.— In Table 2 is shown the number of heat units, or calories, and the weight in ounces of tissue-building material and of mineral salts that ten cents will buy when spent for the common starchy foods. The prices quoted are for single pound lots (bought in August and September, 1913), and they are naturally somewhat higher than are materials bought in quantity. The figures are based on " The Chemical Composition of American Food Materials."*

We see, therefore, that rice is a more expensive energy-giving food than are oats, corn, or wheat, but that the cheaper grades compare favorably with potatoes and macaroni. It is inferior to all five in protein and in mineral matter, but is sometimes to be preferred because of its mildness of flavor and the ease with which it is cooked and digested.

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*United States Office of Experiment Stations. Bulletin No. 28.

TABLE 2.— Comparison of Starchy Food Products

Food	Price per pound	Quantities that can be bought for 10 cents		
		Calories	Protein ounces	Mineral salts ounces
Rolled oats, loose	$0.05	3,700	5.34	.67
Cornmeal, yellow	.05	3,310	2.94	.32
Wheat flour, white	.05	3,300	3.64	.16
Hominy	.05	3,300	2.66	.10
Potatoes (60 cents a bushel)	.01	3,150	2.88	1.60
Broken rice, polished	*.06*	*2,706*	*2.13*	*.11*
Potatoes ($1 a bushel)	.01⅔	1,860	1.72	.96
Macaroni	.10	1,665	2.14	.31
Head rice, polished	*.10*	*1,630*	*1.28*	*.06*
Shredded wheat	.16	1,062	1.05	.21
Puffed wheat	.25	668	.83	.10
Puffed rice	.40	422	.30	.03

RICE AND LEFT-OVERS

Scarcely a day passes that does not see the housekeeper confronted by an array of left-overs, too small in themselves to be of much use but quite too good to be thrown away. The ability to combine these unpromising bits in one or more appetizing dishes, with an individuality all their own, is perhaps the truest mark of culinary genius. The young wife who in desperation grinds up the week-old gingerbread and sees a wonderful steamed pudding rise Phoenix-like from the ruins, experiences the true joy of creation.

Rice in combination with other foods is also popular with the housewife. It combines even more readily than potato combines with milk, cheese, meats, fowl, fish, cold vegetables, and remnants of fresh and preserved fruits; and, besides having decided food value, it adds body to every dish of which it forms a part. It may be used like oatmeal or hominy in muffins, pancakes, and waffles with gratifying results. If it has been well cooked, the kernels, even when cold, are dry and distinct, and will do more than their share toward making up croquettes, casseroles, and salads, and in stuffing peppers.

Rice salads. — The use of rice in salad is still a novelty, and perhaps a word devoted to the subject may not come amiss. A rice salad is often the best solution of the vexing question, "How shall I get up a dainty dish for a hot-weather luncheon or supper which shall be filling enough to satisfy hearty appetites and yet not cost too much?" Left-overs of meat, chicken, and ham may be pieced out with equal quantities of cold boiled rice; canned salmon and tuna fish are really improved by such treatment; cold boiled cod and rice make a most tempting salad; and hard-cooked eggs may always be pressed into service. Left-overs of vegetables may also be used up in this fashion; and owing to its real poverty in mineral salts, rice benefits immensely by this association. French dressing, mayonnaise dressing, and simple boiled dressing are equally good with these salads.

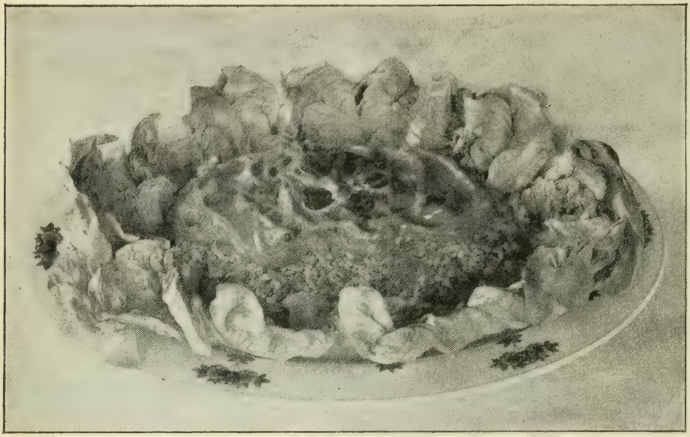

FIG. 65.—*A good salad for the hot-weather luncheon: rice and salmon in equal parts, with boiled or mayonnaise dressing*

It is generally agreed that Americans should eat salad much oftener than they do. At all times, but especially in early spring, we crave acids. This craving is really the crying out of the system for mineral salts and organic acids which it must have in order to counteract the inorganic acids constantly set free through the break down of meats, eggs, and cereal foods; and yet we try to satisfy this need with pickles! Fruits and vegetables supply these salts in generous measure, but by the end of a long winter most of us are heartily sick of carrots, cabbage, and even of potatoes and of stewed fruits. This is the time when salads fill a pressing need. Served with a well-made dressing the familiar vegetables of the winter store take on a new interest, and they may be supplemented by celery, canned peas and beans, canned asparagus, and green peppers and Spanish pimentos. Apples, pears, bananas, oranges, canned pineapple, raisins, and nuts are all available for winter salads, and with crackers and cheese make a pleasing change from pudding and pie for dessert.

RECIPES

Recipes are given below for the use of rice in various ways. The interested housewife will find others in any cook book, and will take pleasure in inventing combinations of her own.

Note: All measures are to be taken *level*.

Rice water for invalids

2 tablespoons rice	Milk
3 cups cold water	Salt

Wash the rice, add the cold water, and soak for thirty minutes. Bring gradually to the boiling point, and cook for one hour or until tender. Strain, reheat, and dilute with hot water or hot milk. Season with salt. Add sugar if desired.

Rice and milk for breakfast

$\frac{7}{8}$ cup rice, whole or broken	1 teaspoon salt
1 quart milk, whole or skimmed	Few gratings of nutmeg
$\frac{1}{4}$ cup sugar	

Use a little less broken rice than whole rice. Wash the rice as directed under "Boiled rice as a vegetable." Drain, and cook with milk, sugar, and salt in the double boiler until the rice is soft and has absorbed most of the milk. Stir occasionally with a fork in order to prevent the rice from sinking to the bottom and to make the liquid creamy. Add nutmeg just before taking from the fire.

Serve hot with cream; or omit the nutmeg and serve with brown sugar. In summer use a little more milk and serve cold with crushed or sliced fruits.

Creamed rice

Add a little more sugar to the above mixture and use a little less rice in order to obtain creamed rice, which is the basis of many simple, but dainty, desserts. For example, when nearly cold, stir in the whites of two eggs or a little whipped cream, together with broken nut meats or candied fruits; or serve in tall glasses with a spoonful of preserves or jam on top, and garnish with whipped cream. Preserved ginger is especially good with this dessert.

Boiled rice as a vegetable

Note: The method given below is the surest of all ways of preparing rice as a vegetable. Success is certain if this simple rule is followed exactly.

1 cup rice	2 tablespoons salt
5 quarts boiling water	

Look the rice over carefully, and place it in a strainer set in a bowl of cold water. Wash it with the hands, changing the water as often as is necessary until all cloudiness disappears. Soak for one hour. Have the water boiling vigorously, add salt, drain the rice, and sprinkle it in so slowly that the water does not stop boiling. Boil violently fifteen minutes, but be careful not to overcook; when no hard core can be felt on pinching the kernel between thumb and finger, it is done. Pour into a colander, *saving the rice water for soup.* Set the colander over a pot containing a little boiling water or in a cool oven, and let it steam until ready to serve. Each grain should be large and perfectly distinct.

Serve as a vegetable by itself in an uncovered dish; or as a border for creamed meats, fish and eggs, fricasseed chicken, veal cutlets, and the like. Hot boiled rice is delicious with tomato sauce, brown gravy, or cheese sauce.

In order to prepare cold rice for croquettes and salads, spread well-steamed rice lightly on a large plate or platter.

Cheese sauce for rice

1½ cup milk
1½ tablespoon flour
¾ teaspoon salt
2 tablespoons butter
1½ cup grated cheese
Cayenne pepper

Stir the flour and the salt smoothly into one half cup of milk; heat the remaining milk carefully to the boiling point, preferably in a small frying pan. Add the butter. Thicken with the flour mixture. Let all boil together for two minutes, and then set aside the pan to cool slightly while grating the cheese. Add the cheese, and bring slowly to boiling, stirring constantly. Season highly with cayenne or white pepper, and serve hot.

Rice in the fireless cooker

1 cup rice
2½ to 3½ cups water
1 teaspoon salt

Look over and wash the rice as directed in the recipe for boiled rice. Bring it to a boil in the salted water and put it into a fireless cooker for one hour.

Uses for rice water

The water left from boiled rice contains too much starch to be wasted. In laundering, it makes a good starch for sheer materials.

Cooked down until thick, it makes an excellent foundation for all kinds of soups, replacing the flour used in thickening. If allowed to cool, it will jelly. Do not keep it too long in warm weather, for it sours easily. Remember that it is already well salted.

Tomato soup

- Rice water from boiled rice
- ½ can tomatoes
- Thick slice onion
- 2 or 3 tablespoons sugar
- ⅛ teaspoonful soda
- 3 tablespoons butter
- 12 pepper corns, or pepper
- 3 cloves
- ⅛ teaspoonful ground thyme
- Salt to taste
- Bit of bay leaf

Simmer rice down to one quart, and then add all ingredients except butter, sugar, and soda. Cook the mixture slowly for twenty or thirty minutes. Press through a sieve, add the remaining ingredients, and reheat before serving.

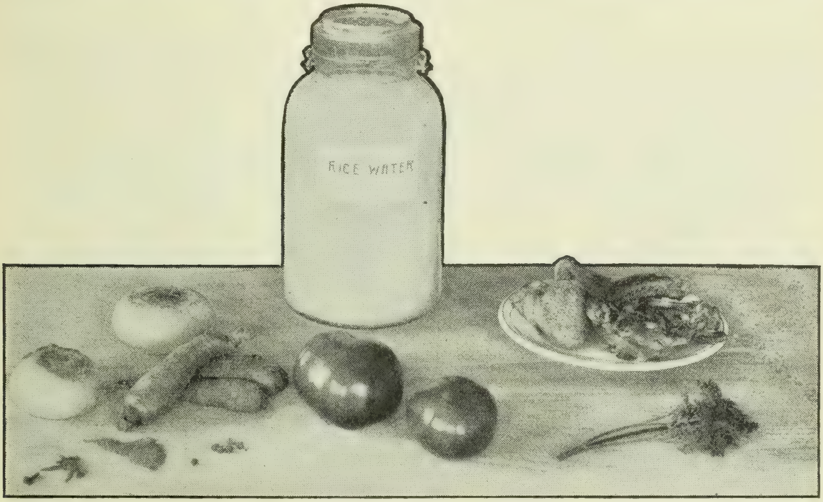

FIG. 66.—*Rice water contains too much starch to be wasted. The careful housewife uses it in combination with other food materials as a basis for delicious soup*

Note: The seasonings mentioned above are inexpensive and keep indefinitely. Every housekeeper should learn what distinction careful seasoning adds even to a simple dish.

Onion soup

In the water left from cooking one cup of rice, place four or five large onions, peeled and cut fine. Cook until the onions are tender and the water is reduced to one quart or less. Pass through a sieve, and add one pint rich milk and two tablespoons of butter. Flavor to taste with salt and pepper and a slight grating of nutmeg.

Baked rice

1 cup rice, brown or white
2½ to 3 cups boiling water
1½ teaspoon salt

Wash the rice. Drain and put in a buttered baking dish. Add boiling water and salt, cover closely, and bake in a quick oven for about three quarters of an hour or until tender. Uncover during the last few minutes, so as to allow rice to dry off. Old rice absorbs more water than new rice absorbs. Brown rice requires about ½ cup more water and one half to three quarters of an hour longer cooking than white rice requires.

Spanish rice

1 cup white or brown rice
4 large ripe tomatoes or ½ can tomatoes
4 teaspoons lard, level
2 tablespoons sugar
2 teaspoons salt
½ teaspoon paprika
¼ teaspoon white pepper or a little cayenne
2 green peppers
1 medium-sized onion, sliced
Bit of bay leaf
Ground thyme

Heat the lard in a heavy frying pan, and in it delicately brown the peppers and the onions. Remove and brown the rice, which has been looked over, but not washed. Add all other ingredients. Cover and let simmer on the back of the stove until soft (three quarters to one hour); add boiling water as the rice swells. Brown rice will require a little longer cooking. The green peppers may be omitted.

Savory rice croquettes

2 cups boiled rice
1 egg beaten
Few drops of onion juice
1 tablespoon lemon juice
½ teaspoon salt
White or cayenne pepper to taste
2 tablespoons minced parsley
2 tablespoons melted butter

Mix all ingredients together, and shape the mixture first into balls and then into cylinders. Roll them in sifted bread crumbs and then in slightly beaten egg until every part is covered; roll in crumbs a second time. Fry in smoking deep fat until golden brown. Test the fat with small cubes of dry bread; when it will turn the cube a golden brown in forty seconds, it is hot enough for any cooked mixture. Drain the croquettes on brown paper. Serve plain or with tomato or cheese sauce.

Tuna fish or salmon salad with rice

Remove bones and skin from the contents of a can of salmon or tuna fish and mince finely. Add an equal amount of cold boiled rice and season with salt, pepper, and vinegar. Stir in plenty of salad dressing, and set away for a while in a cold place. When ready to serve, add a little crisp celery finely cut, or chopped nasturtium stems, and shape in molds moistened with cold water. Turn out on a bed of lettuce leaves, celery tips, or finely shredded crisp cabbage, and garnish with stuffed olives cut lengthwise or with nasturtium blossoms and leaves (Fig. 65).

This salad is hearty enough for the main dish of a family or a church supper.

Egg salad with rice

Arrange crisp lettuce leaves on individual plates. In the center of each, place a generous spoonful of cold boiled rice and on this a spoonful of dressing. A dainty effect may be obtained by arranging on top of this slices of hard cooked egg cut lengthwise, in imitation of an open water lily (Fig. 67).

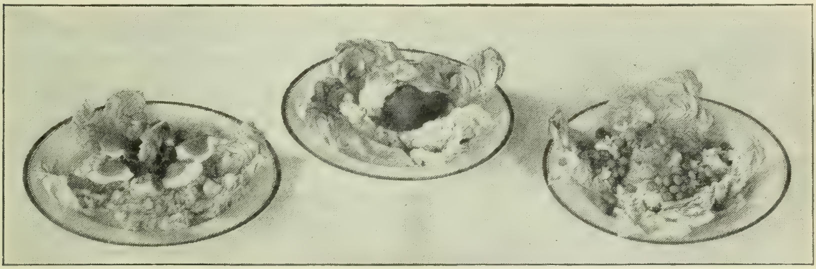

FIG. 67.—*Dainty rice salads. From left to right, rice and egg salad, rice and tomato salad, and rice salad with canned green peas*

Rice and tomato salad

Scald, peel, and chill a small ripe tomato for each person to be served. Cut a cone-shaped piece from the stem end and with a silver fork carefully work in salt and pepper to season. Or remove the inside of the tomato and fill the center with chopped celery, green peppers, and nuts, mixed with salad dressing. Arrange on a bed of lettuce leaves and rice, and place a spoonful of dressing on top.

Boiled dressing in quantity

- 1½ cup milk
- 2 eggs slightly beaten
- 4 tablespoons sugar
- 2½ teaspoons mustard
- 2 teaspoons salt
- 3 tablespoons melted butter
- 2 tablespoons flour
- Cayenne pepper
- ½ cup vinegar

Mix the dry ingredients, and blend with them one fourth cup of the milk. Heat the rest of the milk to boiling, add the butter, thicken with the first mixture, and boil for two minutes. Cautiously pour this hot liquid on the slightly beaten eggs, stirring constantly. Cook over hot water until it begins to thicken; remove, gradually stir in the vinegar, and then carefully reheat until it thickens again. Cool so as to prevent curdling, and pour into scalded glass vessels. This rule makes more than a pint of rather mild dressing which will keep for a long time in a cold place.

Rice with strawberry sauce

½ cup rice
1¼ cup sugar
⅓ cup butter
2 cups milk
1 box strawberries
½ teaspoon salt

Wash rice and cook in the milk until soft, adding one fourth cup of sugar and the salt. Remove the cover and allow the mixture to thicken. Pick over, wash, and mash the strawberries. Add one third cup of sugar, and set in a warm place for a couple of hours in order to extract the juice. Make a hard sauce of the butter and the remaining sugar, and when ready to serve stir into it the strawberries. Have the rice steaming hot, and serve with it a generous helping of sauce.

Southern rice pudding

6 cups of skimmed milk
3 tablespoons sugar
1½ level tablespoon rice
Pinch of salt

Put all ingredients together in a baking dish moistened with cold water. Cook for five or six hours in a slow oven, until the whole is a pale straw color and the rice is nearly disintegrated. Do not remove the brown crust that forms over the top until it is ready to serve. Serve cold with cream.

Rice Bavarian cream

3 cups milk
½ cup rice
Saltspoon salt
Nutmeg
½ cup sugar
1 tablespoon or ½ box granulated gelatin
½ cup cold water
Whites two eggs or 1 cup cream

Wash the rice, simmer it with sugar and salt in the milk until thick and soft. Stir frequently in order to break up the kernels. Soak gelatin in cold water, and then dissolve it in the hot rice mixture. Season to taste with nutmeg or fold in preserves or orange or pineapple marmalade and a little lemon juice. Cool until nearly set. Beat well with a dover beater, and fold in the stiffly beaten whites of two eggs or one cup of thick whipped cream. Turn into glasses or into a mold moistened with cold water. Serve cold with plain or whipped cream.

THE CORNELL READING-COURSE FOR THE FARM HOME

This course was instituted so that the problems of the farm home could be studied in the same scientific way as are those of the farm. The lessons are on such household subjects as relate to food, shelter, and clothing, and are accompanied by discussion papers. The discussion papers contain questions that bring out the point of view of the practical housekeeper. As a result there has been a large personal correspondence with the women of the State, who are at liberty to ask questions at any time relating to their home problems. The Reading-Course for the Farm Home is free to residents of New York State. A lesson is issued each month. For further information address the Department of Home Economics, College of Agriculture, Ithaca, New York.

The lessons available in the Cornell Reading-Course for the Farm Home are as follows:

11 The laundry
13 Cornell study clubs
15 Principles of jelly-making
17 The preservation of food in the home — Part I
19 The preservation of food in the home — Part II
21 The preservation of food in the home — Part III
23 Rules for cleaning
25 Saving strength
27 Choice and care of utensils
29 Cost of food
31 Household bacteriology
33 Vegetable gardening
35 The flower garden
37 Home economics at the New York State College of Agriculture
39 The farmhouse
41 Rules for planning the family dietary
43 The box luncheon
45 Hints on choosing textiles
47 A canning business for the farm home
49 Household insects and methods of control
51 A story of certain table furnishings
53 The Christmas festival
55 Rice and rice cookery

The preceding list is correct to January 1, 1914. The demand may at any time exhaust the supply of particular numbers. Requests will be filled as long as the supply lasts.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

W. A. Stocking, Jr., *Acting Director* A. R. Mann, *General Editor*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 55 JANUARY 1, 1914 **FOOD SERIES No. 8**

RICE AND RICE COOKERY

DISCUSSION PAPER

This discussion paper may be returned with answers to the questions and with any suggestions of your own. While the answering of these questions is not absolutely necessary, much greater benefit will be derived if you share with others your own experience. It will also help us to understand your point of view. The lesson may be used in the grange and in the club where these subjects are considered.

Return the discussion paper to the Supervisor of the Reading-Course for the Farm Home, New York State College of Agriculture, Ithaca, New York.

1. Can you give a good reason why rice and macaroni should not be used at the same meal?

2. Would it be wise to replace potatoes entirely with rice?

3. In what way have you found rice most acceptable in your family dietary?

4. If rice is to form the main part of the meal, what foods should be combined with it to give a well-balanced meal?

Name............................

Address..........................

Date................................

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VOL. III. No. 57 FEBRUARY 1, 1914 **FOOD SERIES No. 11**

A SYLLABUS OF LESSONS FOR EXTENSION SCHOOLS IN HOME ECONOMICS

MIRIAM BIRDSEYE

Introduction by

MARTHA VAN RENSSELAER

At the New York State College of Agriculture, extension schools have been instituted for teaching agriculture and home economics in rural communities. In order to pay a part of the expenses, a nominal fee of one dollar is charged. Wherever a school in agriculture and one in home economics are being conducted, the dollar fee entitles members to attend the session of either school. The school in home economics is held from Monday until Friday, with daily periods of two to two and one half hours

FIG. 68.—*An extension school in home economics held at Lowville, New York, in February, 1914*

each. Work may be arranged for the forenoon or the afternoon, or for both, according to local conditions.

Application for a school in home economics is made to the Department of Home Economics at the New York State College of Agriculture, where the program is made and from which instruction is furnished by members of the Department. Applications for the extension school in home economics may be made on the blank to be furnished by the Department of Home Economics, New York State College of Agriculture, Ithaca, New York.

The school in home economics is more than demonstration in cooking. For those who wish to pursue a definite study of home subjects, instruction in foods, sanitation, household art, and household management is offered. It is not advisable to furnish several subjects in one week. One instructor will follow only one subject. The first schools usually give their attention to food principles and demonstrations in food preparation. Later, sanitation, household art, and household management find a place in the course.

A membership of at least twenty-five persons must be pledged for the entire week before a school can be placed in any locality. Local authorities provide a place for the meetings, announce the school in a community, collect the fees, and furnish the equipment and the assistance requested by instructors.

The following articles are to be furnished by local authorities because of difficulty in shipping:

One long table for literature
Two side and demonstrating tables, size and shape of kitchen tables
Two small, deep dishpans
One teakettle
One waste-paper basket
One small covered stone crock, for garbage
One three-burner kerosene or alcohol stove, trimmed and filled; kerosene or alcohol for refilling
One portable oven, preferably with a glass door
Some provision for keeping food over night: window box, cold closet, or refrigerator
If there is no sink in the part of hall used by the lecturer, the following will be needed:
    Two zinc or enameled water pails
    One dipper

Special types of equipment for demonstration and illustrative material, books of reference, and notebooks will be furnished by the College.

LESSONS FOR EXTENSION SCHOOLS IN HOME ECONOMICS

HOW THE NEEDS OF THE BODY ARE MET BY OUR FOOD

In order to keep well, abundant fresh air, a reasonable amount of directed exercise, sufficient rest, and a determination not to worry are essential. In addition to these requirements the body has need of properly selected and wholesomely prepared food.

I By means of food the body must satisfy three definite needs:

(a) The body is a machine that transforms the energy stored in food into the energy of body heat and of power to do internal and external work. The body, therefore, has need of fuel, or energy-yielding material.

(b) The growing body must constantly increase its muscle, bone, and nerve tissues; the mature body must constantly renew these tissues as they are gradually worn away. Hence the body needs building material.

(c) Food materials must be digested and transported, body wastes must be got rid of, body heat must be kept uniform, and a certain chemical and physical balance necessary to good running order must be maintained. Hence the body needs regulating material.

II Foods have been tested and found to be composed of a number of chemical elements, which are grouped in various ways to form the five food constituents, or foodstuffs, named below. Natural animal and plant foods always contain at least four of the five foodstuffs, although in each food one foodstuff usually predominates in dietary importance. When a food consists of but one foodstuff, as in the case of cane sugar or lard, it has been extracted from some natural food. The most complete and the best balanced foods are milk, eggs, and certain ripened seeds, which have been developed by nature to nourish the growing animal or plant.

III The foodstuffs are:

(a) *Carbohydrates.*— These contain the elements carbon (C), hydrogen (H), and oxygen (O), and are the cheapest of the energy-yielding foodstuffs. Common sources of the carbohydrates are, fruits and vegetables, cereals, bread, macaroni, cornstarch, and potatoes.

(b) *Protein.*— This is called a tissue-builder, because it contains nitrogen (N), an essential component of all cell tissue. The cell is the living, working, reproducing unit of both plant and animal bodies. Besides containing tissue-building nitrogen, protein contains also elements that yield heat; but considered as a fuel food it is expensive, and an excess of protein in the diet may put a serious burden on the kidneys. Good sources of protein are milk, cheese, eggs, lean meat, legumes, cereals, and nuts.

(c) *Fats.*— These also contain C, H, and O, but in different proportions from those present in carbohydrates. Their heating power is two and one quarter times that of either protein or carbohydrates. They rank between the two in expense as fuel foods. Common sources of fats are cream, vegetable oils, and meat fats.

(d) *Mineral matter, or ash.*— This constituent is built up into muscles, bones, and nerves; it helps to regulate the digestion and absorption of food, to keep the blood in good condition, and to rid the body of wastes. Mineral matter is found in all natural foods, but milk, eggs, and vegetable foods are especially valuable sources.

(e) *Water.*— Water enters into the composition of the bones and the soft tissues and also furnishes the liquid part of the blood and other body fluids. It aids in digestion and in the elimination of waste. It is found in all natural foods, but is especially abundant in milk and in watery vegetables and fruits.

WATER IN THE DIET

Water is constantly being lost from the body and must be constantly replaced. Besides the water present in the so-called solid food, we need to drink eight to ten glasses of water daily. Water taken before breakfast helps to cleanse the body by stimulating the activity of the intestines and by furnishing added liquid to the blood and the tissues.

SUGARS AND STARCHES IN THE DIET

I Carbohydrates (sugars and starches) are built up in the green parts of plants from water (H_2O) and carbon dioxid (CO_2) through the action of sunlight, and in these forms they are stored as plant food. When they are broken down in the animal body, they yield the energy stored in them and are reduced to CO_2 and H_2O, substances which are then eliminated by lungs, kidneys, and skin.

The main purpose of carbohydrates in the diet is to furnish the body with energy. They are the cheapest of the energy-yielding foods and must play an important part in each day's meals.

II Sugar is found in solution in the sap of juicy, or succulent, roots, stems, seeds, or fruits. When eaten in small quantities, it is easily and rapidly digested. If, however, a large amount of sugar is eaten at one time it irritates the mucous membrane of the digestive tract, may produce acid fermentation in the stomach, and, because it is so easily digested, is absorbed more rapidly than the body can care for it; hence it may overwork both liver and kidneys. The great bulk of our carbohydrate food, therefore, should consist of starch, which is changed slowly to sugar and thus is not likely to overcrowd the body with sugar at any one time. The best forms in which to include sugar in the diet are in fruits and vegetables or in desserts at the close of the meal.

III Starch grains are found packed in the cells of the storage organs of plants, the walls of which are made of cellulose. Starchy foods should be sufficiently cooked to soften and burst both the cellulose wall and the starch grains inside of it; the time required for cooking starchy foods depends on the amount and toughness of the cellulose, the amount and character of the starch grains, and the amount of water present in the cell. For example, potatoes, having little cellulose and much water, will not need so long cooking as will cracked wheat, which contains little water and in which the cellulose is tough and resistant to the action of heat and water. Starchy foods should be thoroughly chewed. Digestion of starch begins with the saliva in the mouth, ceases when thoroughly penetrated by the stomach juices, and recommences in the intestines. All digestible carbohydrates are ultimately changed to sugar and carried to the liver, which passes on a fixed percentage to the blood. The blood carries it to the muscle cells, where it serves as fuel. If the sugar supply brought by the blood is not immediately used, it is stored as fat, to be drawn on as it is needed. Most of the carbohydrates in the diet should be in the form of the starchy vegetables, cereals, and cereal products.

IV The large calorie is the unit by which we measure the heat-producing power of a substance. A large calorie is that amount of heat which will raise the temperature of 1000 grams (about 1 quart) of water 1° C.

V The heating power of pure carbohydrate is approximately 1820 heat units, or calories, for each pound. Pure protein has the same fuel value; pure fat has two and one quarter times as great heating power, or approximately 4080 calories for each pound. One way of comparing foods is on the basis of their heating power. In Table 1 such a comparison is given:

TABLE 1. Starchy Foods, Compared on a Cost Basis as to Heating Power and Building Value*

Food	Cost per pound	Amount purchasable for ten cents		
		Calories	Protein (ounces)	Mineral salts (ounces)
Rolled oats, loose	$0.05	3,700	5.34	0.67
Cornmeal, yellow	.05	3,310	2.94	0.32
Wheat flour, white	.05	3,300	3.64	0.16
Hominy	.05	3,300	2.66	0.10
Potatoes (60 cents a bushel)	.01	3,150	2.88	1.60
Broken rice, polished	.06	2,706	2.13	0.11
Potatoes ($1 a bushel)	.01⅔	1,860	1.72	0.96
Macaroni	.10	1,665	2.14	0.31
Head rice, polished	.10	1,630	1.28	0.06
Shredded wheat	.16	1,062	1.05	0.21
Puffed wheat	.25	668	0.83	0.10
Puffed rice	.40	422	0.30	0.03

* The statistics in the foregoing table are compiled from the United States Office of Experiment Stations, Bulletin 28.

VI The amount of energy (number of calories) used by the average adult body in a day depends mainly on two factors:

1. The amount of muscular work performed.
2. The size of the body.

References [1]

Cost of food. Cornell reading-course for the farm home Vol. II, No. 29.

Principles of nutrition and the nutritive value of food. U. S. Dept. Agr. Farmers' bulletin 142 (revised).

Sugar and its value as food. U. S. Dept. Agr. Farmers' bulletin 535.

Bread and bread making. U. S. Dept. Agr. Farmers' bulletin 389.

Cereal breakfast foods. U. S. Dept. Agr. Farmers' bulletin 249.

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[1] The farmers' bulletins cited as references are sent free on application to the Editor and Chief of the Division of Publications, U. S. Department of Agriculture, Washington, D. C. Because of the limited supply, applicants are urgently requested to ask only for those publications in which they are particularly interested. Not more than one copy of any publication can be sent to an applicant. In applying for these publications the name of the series and the number of the bulletin or the circular should be given.

A list of free and available publications of the United States Department of Agriculture on subjects of interest to farm women has been compiled and will be sent free on application to the Editor and Chief of the Division of Publications, U. S. Department of Agriculture, Washington, D. C.

Price lists of government publications that are for sale are issued by the Superintendent of Documents, Government Printing Office, Washington, D. C., and are sent on application. The following may contain titles of interest to farm women: Price list 51, Health and hygiene, including water pollution and purification, food and diet, and the like; Price list 52, Poultry, birds.

The Cornell reading-course lessons are sent free on application to residents of the State.

Comparative measures and weights

Accuracy of measurement is necessary for accuracy in all processes of food preparation. The following comparisons of quantities may prove useful to the housewife:

(All measurements are taken level)

3 teaspoonfuls make 1 tablespoonful
16 tablespoonfuls (dry material) make 1 cupful
14 tablespoonfuls (liquid) make 1 cupful

It is equally desirable to know the equivalent weights of the measurements called for:

2 cupfuls butter packed solidly	1 pound
2 cupfuls sugar	1 pound
2 cupfuls meat finely chopped	1 pound
2⅔ cupfuls powdered sugar	1 pound
2⅔ cupfuls brown sugar	1 pound
2⅔ cupfuls oatmeal	1 pound
4¾ cupfuls rolled oats	1 pound
4 cupfuls flour	1 pound
9 or 10 eggs	1 pound
2 tablespoonfuls butter	1 ounce
4 tablespoonfuls flour	1 ounce
1 egg, slightly beaten	4 tablespoonfuls
1 lemon (juice)	3 tablespoonfuls

Suggestive recipes for cooking starchy and sugary foods

One loaf of bread made with liquid yeast

⅓ cupful liquid yeast
½ teaspoonful salt
1 tablespoonful sugar
Flour (about 4 cupfuls)
1 tablespoonful butter or
¾ tablespoonful lard
1 cupful milk

Scald the milk, add butter or lard, sugar, and salt. When lukewarm, add the yeast and stir well. Add the flour gradually, stirring well until the dough is stiff enough to knead.

Place one half cupful flour on the kneading board. Remove the dough from the mixing bowl and knead until it does not stick to the hands or to a board that has no flour on it. Wet the mixing bowl and roll the dough in it until the surface of the dough is moist. Cover and set away in a warm place to rise over night. Bread made by this rule may be allowed to rise over night. When the dough is light, knead and shape into a loaf, if possible without adding any flour to the board. Put into a greased pan. Cover and set in a warm place to rise. Let it rise until about twice as large as when put in the pan. Bake in a moderate oven for forty-five to sixty minutes. The oven should not be too hot for the first fifteen minutes, as the bread should continue rising in the oven. The heat should then be increased, should be greatest during the second fifteen minutes, and should again be diminished during the last fifteen minutes. Use only a standard grade of bread flour.

Liquid yeast

3 medium-sized potatoes
2 tablespoonfuls sugar
1 dry yeast cake
1 quart water
2 teaspoonfuls salt

About noon, or as soon after as possible, boil the potatoes in one quart water. When cooked soft, mash in water, add sugar and salt, and let cool. Soak the yeast cake in one half cupful lukewarm water for fifteen minutes, then add it to the cooled potato mixture. Cover, and put in a warm place to rise. Stir occasionally. By the next morning the yeast may be used for bread.

Any yeast remaining may be covered, set in a cool place, and kept for making more bread. Liquid yeast, or starter, should keep for two weeks.

Description of a perfect loaf of bread

The following description of a perfect loaf of bread is introduced here because of its general interest in this connection:

Flavor: Taste.— Sweet, nutty, free from acidity and taste of yeastiness. No suggestion of rawness.

Odor.— Pleasant, slightly sweet fragrance, with no hint of acid or yeast.

Crumbs: Texture.— Fine-grained, evenly distributed air spaces, tender and elastic.

Moisture.— Free from sogginess or dryness. Moist enough to make the bread springy.

Lightness.— Well risen, with no suggestion of heaviness or compactness of crumb produced by insufficient rising or too much flour.

Color.— White or creamy white. No grayness.

Crust: Color.— Deep golden brown.

Depth.— A moderately deep crust, showing careful baking.

Crispness.— Moderately crisp, not tough.

Texture.— Flaky, free from bubbles.

General appearance: Size.— Not larger than 4 or 5 inches thick, 8 or 9 inches long, and 4 or 5 inches wide. Large loaves frequently have poor taste and odor because of insufficient baking.

Shape.— Regular, rounded at top, sides even and unbroken.

One loaf of bread made with dry yeast

½ cake dry yeast softened in
¼ cupful lukewarm water to which is added
½ teaspoonful sugar
1 cupful milk
1 tablespoonful sugar
Flour, about 4 cupfuls
1 tablespoonful butter or
¾ tablespoonful lard
½ teaspoonful salt

Put the yeast cake to soak about noon in the lukewarm water sweetened with one half teaspoonful sugar, and let this stand for one half to one hour. Scald the milk, add butter or lard, sugar, salt, and then cool. When lukewarm, add the softened yeast cake and stir well. Add part of the flour to make a batter (about one and one half to two cupfuls), and beat well. Cover, set in warm place, and let rise until light (this should be ready at about six or seven o'clock). Add sufficient flour to make the dough stiff enough to knead, and knead until the dough does not stick to the hands or to a board that has no flour on it. Wet the mixing bowl, and roll the dough in it until the surface of the dough is moist. Cover, and set away in a warm place to rise over night. When the dough is light, knead and shape into a loaf, if possible without adding any flour to the board. Put into a greased pan, cover, and set in warm place to rise. Let the dough rise until it is twice as large as when put to rise. Bake in a moderate oven for forty-five to sixty minutes. The oven should not be too hot for the first fifteen minutes. The heat should be increased during the second fifteen minutes and should be diminished during the last fifteen minutes. When the loaf is done, remove from the pan and cool as quickly as possible in a current of air.

Baking-powder biscuit

2 cupfuls flour
4 teaspoonfuls baking powder
1 teaspoonful salt
2 tablespoonfuls shortening
¾ cupful milk

Mix the dry ingredients and sift twice. Cut in the shortening with a knife; add the liquid gradually, mixing to a soft dough. Toss on a floured board; pat and roll to one half inch in thickness. Shape with a biscuit-cutter. Place on a tin greased with lard, and bake in a hot oven for twelve or fifteen minutes.

Twin-mountain muffins

⅓ cupful shortening
¼ cupful sugar
¼ teaspoonful salt
4 teaspoonfuls baking powder
1 egg
¾ cupful milk
2 cupfuls flour

Cream the shortening, add the sugar gradually, then add alternately the egg beaten and mixed with the milk, and the flour and the baking powder sifted together. Bake in muffin tins for about twenty-five minutes.

Date muffins

Add to the preceding mixture one quarter pound dates chopped fine. Reserve one half tablespoonful flour in order to dredge fruit.

Corn-meal muffins

6 tablespoonfuls shortening	⅓ cupful sugar
1 cupful milk	1 cupful corn meal
2 cupfuls flour	2 eggs
4 teaspoonfuls baking powder	

Cream the shortening, add the sugar, and continue creaming. Separate the eggs, beat the yolks, and add to it the milk. Set aside the whites until the last. Mix meal, flour, and baking powder. Add liquid and dry ingredients alternately to the creamed fat and sugar, beating well between the additions. Lastly add the whites beaten stiff, folding them in very carefully. Grease the muffin pans with lard, half-fill them with the mixture, and place at once in a hot oven. The mixture may be baked in an ordinary baking pan and cut into cubes.

Graham nut bread

Sift out and discard the bran from a quantity of graham flour. Then sift together, three times, three cupfuls of graham flour, one half cupful of white flour, one teaspoonful salt, and five teaspoonfuls baking powder. Add one cupful sugar, one cupful nut meats, chopped fine, two to two and one half cupfuls milk, and mix the whole to a dough. Bake for about one hour.

One cupful of chopped dates rolled in flour may be added, if desired.

Cereals

The amount of water required to cook a cereal is approximately in proportion to the weight of the cereal. The length of time required for cooking a cereal depends on whether the cereal has been partially cooked previously and whether it is finely ground or in coarse particles. The time for cooking depends also on the nature of the constituents in the cereal.

TABLE 2. SHOWING THE REQUIREMENTS OF DIFFERENT CEREALS

Kind	Amount	Salt	Water	Time
	(cup)	(teaspoon)	(cups)	(hours)
Granular cereals	1	1	2 to 6	¾ to 3
Hominy	1	1	4 to 5	1 to 3
Graham or whole wheat flour	1	1	4 to 5	1 to 2
Corn meal	1	1	4 to 6	1 to 3
Rolled oats	1	1	2 to 3	1 to 3
Oatmeal	1	1	4 to 6	4 to 8
Cracked wheat	1	1	4 to 6	6 to 10

Use the fireless cooker or a double boiler. Look the cereal over carefully and pour slowly into the required amount of boiling water. Cook over direct heat until the mixture thickens, stirring so as to keep it from burning. Finish over boiling water or in the fireless cooker. Serve hot with cream and sugar.

Rice and milk for breakfast

$\frac{7}{8}$ cupful rice, whole or broken	$\frac{1}{4}$ cupful sugar
1 quart milk, whole or skimmed	1 teaspoonful salt
Few gratings nutmeg	

Use a little less broken rice than whole rice. Wash well, drain, and cook with milk, sugar, and salt in the double boiler until the rice is soft and has absorbed most of the milk. Stir occasionally with a fork in order to keep the rice from settling at the bottom and to make the liquid creamy. Add the nutmeg just before taking from the fire.

Serve hot with cream; or omit the nutmeg and serve with brown sugar. In summer, use a little more milk and serve cold with crushed or sliced fruits.

Creamed rice

By using a little more sugar and a little less rice, we have creamed rice, the basis of many simple but dainty desserts. For example, when nearly cold stir in the beaten whites of two eggs or a little whipped cream; add broken nut meats or candied fruits· or serve in tall glasses with a spoonful of preserves or jam on top and garnished with whipped cream.

Boiled rice as a vegetable

1 cupful rice
5 quarts boiling water
1½ to 2 tablespoonfuls salt

Look the rice over carefully, and put it in a strainer set in a bowl of cold water. Wash it with the hands, changing the water as often as necessary until all cloudiness disappears. Soak for one hour. Have the water boiling vigorously, add the salt, drain the rice, and sprinkle it in so slowly that the water does not stop boiling. Boil violently for fifteen minutes, then pour into a colander, saving the rice water. Set the colander over a pot containing a little boiling water, and let it steam until ready to serve. The grains should be dry and perfectly distinct.

Rice water for soups

The rice water mentioned in the foregoing recipe contains a considerable amount of starch that should not be wasted. Cooked down until thick, it makes an excellent foundation for tomato, vegetable, chicken, and even meat soups, replacing the flour or the cornstarch used in thickening. If allowed to cool, the rice water will jelly. Do not try to keep it too long in warm weather, for it sours easily. Remember, too, that it is already well salted.

Baked rice

1 cupful rice, white or brown
2½ to 3 cupfuls boiling water
1½ teaspoonful salt

Wash the rice, drain, and place in a buttered baking dish. Add the boiling water and the salt, cover, and bake in a quick oven until soft — one half to one hour. Uncover, and let steam until dry in a warm place. Old rice takes up more water than new rice does. Brown rice requires fully three cups of boiling water and needs to be cooked for an hour or more.

Stewed potatoes

1 quart sliced raw potatoes
2 ounces fat bacon
½ teaspoonful onion juice
¼ teaspoonful pepper
1 teaspoonful salt
1 tablespoonful flour
½ cupful water or milk

Slice potatoes and bacon thin. Spread half the latter on the bottom of a baking dish. Add half the potatoes, and sprinkle with half the seasoning. Add the remaining potatoes and then the rest of the seasoning. Blend the water and flour, pour into a dish, and spread the remainder of the bacon on top. Cover closely, and cook for forty-five minutes in a moderate oven. Remove the cover, and cook for twenty minutes longer in order to brown the bacon.

Hashed brown potatoes

Try out fat salt pork cut in small cubes and remove the scraps; there should be about one third cup of fat. Add two cups cold boiled potatoes finely chopped, one eighth teaspoonful pepper, and salt if it is needed. Mix the potatoes thoroughly with the fat; cook for three minutes, stirring constantly; let stand so as to brown underneath. Fold as an omelet, and turn out on a hot platter.

Tapioca cream

¼ cupful pearl tapioca or
1½ tablespoonful minute tapioca
2 eggs
2 cupfuls scalded milk
1 teaspoonful vanilla, or juice and grated peel of ½ small orange
⅓ cupful sugar
¼ teaspoonful salt

Pick over the tapioca and soak for one hour in enough cold water to cover; then drain, add to milk, and cook in a double boiler until the tapioca is transparent. Add half the sugar to the milk and the remainder to the slightly beaten egg yolks and the salt. Combine by pouring the hot mixture slowly on the egg mixture, return to double boiler, and cook until it thickens. Remove from the range, and add the whites of the eggs, beaten stiff. Chill and flavor.

Chocolate bread pudding

2 cupfuls stale bread crumbs
4 cupfuls scalded milk
2 squares Baker's chocolate or
¼ cupful cocoa
¼ teaspoonful salt
⅔ cupfuls sugar
2 eggs
1 teaspoonful vanilla

Soak the bread in three cupfuls milk for thirty minutes. Cut the chocolate small, add the sugar and other seasonings and the remainder of the milk. Cook slowly until the chocolate is dissolved and the mixture is smooth. Add this to the bread-and-milk mixture, stir in the eggs slightly beaten, and bake in a buttered baking dish for one hour in a moderate oven. Serve with hard sauce or with cream and sugar.

Amber pudding

¼ box gelatin or
1 tablespoonful granulated gelatin
¼ cupful boiling water
Lemon juice if desired
1¼ cupful cider
Sugar to taste
Whites of 3 eggs

Soak gelatin in two tablespoonfuls cider, and then dissolve in boiling water. Stir this into the cider. Sweeten to taste, strain, and set aside in a cool place. When a spoon drawn through leaves a mark, beat with a whisk or a wire spoon until frothy. Then add the whites of eggs beaten stiff, and continue beating until the pudding is stiff enough to hold its shape. Mold, or pile by spoonfuls in tall individual glasses.

Banana custard

2 cupfuls milk
¼ cupful sugar
6 freshly sliced bananas
⅛ teaspoonful salt
1 tablespoonful cornstarch
¼ teaspoonful vanilla
1 egg

Scald all but one quarter cupful milk in the double boiler with the sugar and the salt. Blend the remaining milk with the cornstarch, and add this mixture to the scalded milk, stirring constantly until it thickens. Cook for ten minutes, and then pour gradually over the slightly beaten egg, still stirring. Return to the fire for a few minutes so as to cook the egg, but do not curdle it. This amount of custard is ample for eight to ten portions.

Chill the custard and pour over freshly sliced bananas. Garnish with whipped cream and candied cherries.

Nut caramel pudding

- 1 quart boiling water
- 5 to 6 tablespoonfuls cornstarch
- ¼ teaspoonful vanilla
- ½ cupful broken nut meats
- 3½ cupfuls light brown sugar
- ¼ cupful cold water

Boil sugar and water together for ten minutes. Stir the cornstarch into cold water, add to the sirup, and boil for five minutes, stirring constantly. Add broken nut meats and vanilla, and pour into individual glasses. Serve with plain or whipped cream.

Pineapple Bavarian cream

- ½ box gelatin or
- 2 tablespoonfuls granulated gelatin
- ½ cupful cold water
- 1 can grated pineapple
- ½ cupful sugar
- 1 tablespoonful lemon juice
- Whip from three cups thin cream

Soak the gelatin in cold water. Heat the pineapple, add sugar, lemon juice, and soaked gelatin; chill in a pan of ice water, stirring constantly; when the mixture begins to thicken, fold in the whip from cream, mold, and chill. This rule makes twelve generous portions of a very rich dessert.

To whip cream

Cream can be whipped only after it has developed a certain degree of acidity; hence, for whipping choose cream at least thirty-six hours old. It may be artificially acidified, however, by adding a little cream of tartar dissolved in boiling water and cooled. The cream must be thoroughly chilled in order to whip successfully.

Heavy cream may be whipped with the dover beater. Be careful not to beat too long and so change the cream to butter.

Thin cream is whipped by using a whip churn, as is heavy cream when diluted with one half to two thirds its bulk in milk. Place the churn in a bowl containing cream; hold down the cover with the left hand, and with the right hand work the dasher with quick downward and slow upward motions; avoid raising the dasher too high in the cylinder, and thus escape the spattering of the cream. The first whip that appears should be stirred into the cream, as the air bubbles are too large and will break; the second whip should be removed by spoonfuls to a strainer, and the strainer should be placed in a pan, as some cream will drain through.

The first cream which drains through may be turned into bowl and be rewhipped; continue whipping as long as possible.

Apple pie

Crust

1½ cupful pastry flour
½ teaspoonful salt
½ cupful shortening
3½ tablespoonfuls cold water

Sift the flour and the salt together, cut in the shortening with two knives until it looks mealy. Add the water gradually, cutting it in with a knife. When all is moist, turn out on a lightly floured board and roll one eighth inch thick.

Filling

Sprinkle the lower crust with flour, and then add one cupful sugar. Pare the apples, slice them thin, and place in an orderly manner. Add one quarter teaspoonful salt, one half teaspoonful cinnamon or nutmeg, and one half tablespoonful butter. Cover with the upper crust and bake in a moderate oven for one hour.

Note.— If the juice boils out, lower the temperature of the oven.

Lemon or orange pie

Crust

1 cupful flour
5 tablespoonfuls shortening
½ teaspoonful salt
2 tablespoonfuls water

Combine the ingredients as for apple pie. Roll the paste very thin. For all pies made with one crust, use a deep pie plate and line it without stretching the paste in the least. Remember that all pastry shrinks in the baking, and allow for this shrinkage. Trim the edges with a fork or by fluting, and prick every part of the center and the sides with a fork before placing at once in a quick oven. If a gas range is used, place the pastry on a shelf near the top; if a coal range is used, place where a good bottom heat can be obtained.

Note.— Pastry burns readily, and these crusts are very thin.

Filling

1½ tablespoonful cornstarch
1 cupful boiling water
1 cupful sugar
1 large lemon or orange (juice)
1 large lemon or orange (rind)
Yolk of 1 egg
¾ tablespoonful butter
Pinch salt

Separate yolk and white of the egg. Mix the cornstarch to the consistency of cream with cold water. Add the boiling water until the cornstarch loses its whiteness and becomes transparent. Add the sugar, let the mixture boil up once over the fire, and then place in a double boiler over hot water for one half hour. When cooked for fifteen minutes, add the grated rind and the piece of butter, and allow to cook until no taste of cornstarch is perceptible. Remove from the fire, add the beaten yolk of the egg, juice of the lemon or the orange, and a generous pinch of salt. Pour into the baked crust. Add the meringue, and brown in a quick oven.

Meringue

Beaten white of egg and one tablespoonful powdered sugar to make tender.

Suggestions for baking cake

In baking cake divide the time required into quarters. During each quarter the baking should proceed as follows:

First quarter, the mixture should begin to rise.

Second quarter, it should continue rising and begin to brown.

Third quarter, it should continue browning.

Fourth quarter, it should finish baking and shrink from the pan.

If the oven is too hot, open the check and raise the back covers, or open the oven door.

It is sometimes necessary to cover the cake with brown paper; there is, however, danger of the cake adhering to the paper.

Cake should be looked at often during baking; if the oven door is opened and closed carefully, there is no danger of the cake falling.

Cake should not be moved in the oven until fully risen. After this time it is desirable to move it so that it will brown evenly.

When it is done, the cake shrinks from the pan and does not retain indentation when pressed with the finger.

Place the cake as nearly in the center of the oven as possible. If it is too near the firebox, one side will burn before the other side is cooked.

If the cake is put in too slow an oven, it rises over the sides of the pan and is coarse in texture. If the oven is too hot, the cake browns before sufficiently risen and breaks through the crust in its attempt to rise.

Cake will crack if too much flour has been used.

The oven should be kept as nearly uniform in temperature as possible.

Small layer cakes require a hotter oven than does loaf cake.

Marshmallow cake

½ cupful butter
½ cupful milk
3 teaspoonfuls baking powder
½ teaspoonful vanilla

1 cupful sugar
2 cupfuls flour
½ teaspoonful salt
Whites of 4 eggs

Cream the butter, add the sugar, and continue creaming. Mix and sift dry ingredients and add alternately with the milk (adding a little flour first). Add the vanilla, beat thoroughly, and then fold in the stiffly beaten whites of egg. Bake in two layers.

Filling

1½ cupful sugar
½ cupful water
1 teaspoonful vanilla
Whites of 3 eggs
½ pound marshmallows

Put sugar and water in a saucepan, stir until the sugar is dissolved, and heat to the boiling point gradually, without stirring, until the sirup will thread when dropped from the tip of a spoon. Pour the sirup gradually on the beaten egg white, beating the mixture constantly, and continue beating until a right consistency for spreading is obtained. Add the flavoring and the marshmallows cut into pieces.

Little gold cakes

¼ cupful butter
1 cupful flour
1 teaspoonful orange or lemon extract
½ cupful sugar
1 teaspoonful baking powder
Yolks of 4 eggs
¼ cupful milk

Cream the butter, add the sugar, the yolks well-beaten, and the milk alternately with flour mixed and sifted with baking powder. Beat thoroughly, add the flavoring, and bake in small tins. Frost with egg icing.

Egg icing

Beat the white of an egg until it is light. Then beat into it gradually powdered sugar until the egg is thick enough to spread. Add one quarter teaspoonful lemon or vanilla extract or one teaspoonful lemon or orange juice, and spread on the cakes. Two teaspoonfuls melted chocolate or two teaspoonfuls shredded cocoanut may be used in place of other flavoring. The yolk of an egg may be used instead of the white, to make sunshine frosting.

Plain cake

¼ cupful butter
1 cupful sugar
2 eggs
½ cupful milk
2 teaspoonfuls baking powder
1½ cupful flour
⅛ teaspoonful nutmeg or 5 drops flavoring extract

Beat yolks and whites of eggs separately, adding the yolks to creamed sugar and butter. Otherwise follow the rule for mixing marshmallow cake. One half ounce melted chocolate may be added after the yolks of the eggs, or one tablespoonful of currants, raisins, chopped citron, or nuts may be mixed with one teaspoonful of the flour and added before the whites of the eggs.

FATS AND FATTY FOODS IN THE DIET

I Fats, like starches and sugars, are energy-yielding foods. They contain the same chemical elements as do the carbohydrates, but in different proportions. Their heating power is two and one quarter times as great as that of either carbohydrates or protein; hence they are the concentrated energy-yielding foods.

II Both plants and animals have the power to change excess sugar into fat and to store it away in certain tissues as a reserve supply of food. Thus the fats are found in foods of both plant and animal origin.

III Experiment and experience seem to indicate that a normal diet should include both fat and carbohydrates, but that it is unwise to allow the fat to contribute more heat than do the sugars and starches.

IV Some fats are more valuable to the body than others are. The fats of eggs and milk seem especially usable by growing children, not only because they furnish energy, but also because of their power to stimulate growth.

V The softer a fat is, the more easily it seems to be digested; oils, cream, butter, bacon, chicken fat, and lard are more easily managed by the digestive organs than are beef drippings and mutton tallow. Fats in the form of an emulsion, as in cream, milk, and egg yolk, are particularly easy to digest.

VI The saliva contains no ferment that can begin the digestion of fat; and there is very little provision for fat digestion in the stomach. It is in the small intestine that fat begins to be digested.

VII The presence of considerable quantities of fat in the stomach may check the flow of digestive juices and delay the passage of food from the stomach into the intestines. Fatty foods " stay by " for a long time. In some cases, as in severe muscular work, this may be desirable, in others quite the reverse. The use of more fat than the digestive organs can manage may result in retarded digestion, in the formation and absorption of irritating acid substances, and in the removal from the body of substances needed by it.

VIII A diet rich in fats should include a generous proportion of fruits, for fat slows up the digestive processes and fruit acids cause digestion to be resumed.

IX Fats used as shortening serve to separate the starch grains of flour mixtures and thus make them tender. Lard, crisco, beef drippings, and chicken fat have a slightly higher shortening power than has butter.

X Food properly fried in deep fat absorbs less grease than when sautéed in shallow fat. For frying and for sautéing, fat should be hot enough to form a coating over the outside of the food immediately and thus prevent the grease from being soaked up into the interior of the food.

Milk, as a food and as a source of fat

I Milk contains all five of the foodstuffs in very usable form. It thus ministers to the upbuilding and the regulating of the body, as well as supplies it with energy. Milk increases the food value of every dish of which it forms a part.

II One hundred pounds of good milk contains on the average three and three tenths pounds protein, four pounds fat, five pounds milk sugar, seven tenths pound mineral matter, and eighty-seven pounds water.

III Milk contains a considerable amount of lime and phosphorus, but is poor in iron.

IV Milk makes an almost ideal food for the infant and for the invalid (see V). For growing children and for adults, it is too dilute and must be supplemented by more concentrated foods and by foods richer in iron.

V In feeding the sick, a safe rule to follow is to reduce both the quantity and the strength of the food given, in proportion as the digestion has become weakened. A very sick person needs much the same kind and amount of food as a tiny baby.

VI Plan to have plenty of milk in the family dietary. Growing children require it, adults also should use it. One cannot afford to scrimp the family on milk, our most economical and complete building material. If whole milk costs too much, buy skimmed milk. Skimmed milk, however, has lost the fat which, as has been said before, is stimulating to growth. Whole milk should, therefore, be used at least for the children in the family. Buttermilk has much the same food value as skimmed milk. Sour milk and buttermilk, besides being valuable foods, cleanse the intestine of putrefactive germs by seeding it with lactic-acid bacteria.

VII Cocoa, milk soups, white sauces, custards, junket, and puddings are forms in which cooked milk may be added to the diet.

VIII There are two forms of protein present in milk. The albumin is coagulated, or solidified, by heat (as in the scum on boiled milk); the casein is coagulated by acid (as in cottage cheese), and by the digestive ferment rennin (as in junket).

IX The whey from junket contains albumin, milk sugar, and valuable mineral salts, and is frequently used in modifying milk for babies and for an invalid drink.

X Cheese is a valuable, but concentrated, food. If swallowed in large pieces it is slow to digest. It should be finely chewed, or preferably grated or melted into sauce. Cottage cheese is easier to digest than the more compact forms are, and should occupy a conspicuous place among the protein foods on the farm table. Macaroni and cheese, boiled rice with grated cheese or cheese sauce, or cottage cheese and brown bread make good farm supper dishes, particularly if a green salad is eaten with the meal.

XI Milk is an easily contaminated food in which, under favorable conditions, germs may multiply with incredible rapidity. While many of these germs may be harmless, there is always the danger that they may be of the disease-producing type. Every effort should therefore be made to produce clean milk and to keep it clean. A low temperature checks the growth of bacteria present in milk. Milk should therefore be cooled quickly and should be kept in a cool place. Boiling milk for ten minutes will probably destroy all germs present in it. Heating milk to 60° C. (140° F.) for twenty minutes will probably destroy all disease-producing germs. Such milk, however, should be used within twenty-four hours after heating.

XII The person who sells milk for human consumption is morally, if not legally, responsible for keeping it clean and free from disease-producing germs.

XIII In order to produce safe milk we must have clean cows that are free from disease, clean stables, clean hands, clean, well-scalded pails (preferably with small openings) and cans, and rapid and complete cooling of the milk in a room free from dust and flies.

XIV Cleanse milk vessels as follows: Rinse the utensils well in cold water; wash with hot water and washing powder or soap; scald with boiling water or live steam. Allow them to dry by themselves in a place free from dust.

XV To use dirty milk is to make a bid for the doctor's services. If your milk supply is unsatisfactory, pasteurize all drinking milk until you can change dealers or remedy conditions.

XVI In order to pasteurize milk at home, pour it into scalded bottles and stopper with nonabsorbent cotton. Set the bottles on a rack in a bath of cold water, cover closely, and heat gradually to a temperature of 160° F. Let the bottles stand in the warm water for twenty minutes, remove, and cool quickly, still stoppered. Use within twenty-four hours. Pasteurizing destroys the lactic-acid and many other bacteria, and does not cause the changes in the assimilability of milk which may possibly result from boiling.

References

The use of milk as food. U. S. Dept. Agr. Farmers' bulletin 363.

The care of milk and its use in the home. U. S. Dept. Agr. Farmers' bulletin 413.

Cheese and its economical uses in the diet. U. S. Dept. Agr. Farmers' bulletin 487.

Cheese-making on the farm. U. S. Dept. Agr. Farmers' bulletin 166.

Suggestive recipes for dishes containing milk

TABLE 3. SHOWING PROPORTIONS OF INGREDIENTS THAT SHOULD BE USED WITH ONE CUP OF MILK

Food	Ingredients used to 1 cup milk
Junket	¼ junket tablet
Baked or boiled custard	1 egg
Baked custard to turn out	1¼ eggs
Cheap custard	½ egg and ½ tablespoonful cornstarch
Blancmange	1½ tablespoonful cornstarch
Breakfast cocoa	2 teaspoonfuls cocoa
Tapioca cream	2 scant tablespoonfuls pearl tapioca and 1 egg
Thin white sauce	1 tablespoonful flour and 1 tablespoonful butter
Medium white sauce	2 tablespoonfuls flour and 2 tablespoonfuls butter
Thick white sauce	3 to 5 tablespoonfuls flour and 3 tablespoonfuls butter
Eggnog	1 well-beaten raw egg

Junket

1 quart milk
1 junket tablet
Nutmeg or other flavoring as desired
1 tablespoonful water
Sugar to taste

Warm the milk gently, stirring constantly, until a drop no longer feels cool on the back of the hand. Stir in the sugar and the tablet dissolved in water; pour into glass cups or into a dish, and grate nutmeg over the top. Let stand in a warm place until set, and then chill immediately. Serve with cream and sugar or with preserved or crushed fruit.

Whey

Using the foregoing rule, turn well-set junket gently into a piece of double cheesecloth wrung out of hot water, and set in a strainer. Break the junket up lightly. The whey will drain through. It contains albumin, milk sugar, and much of the mineral matter of the milk, and is prepared for young children and for invalids.

Breakfast cocoa

3 tablespoonfuls cocoa
¼ cupful sugar
Few grains salt
1 cupful boiling water
3 cupfuls milk

Scald the milk. Mix cocoa, sugar, and salt, and make into a smooth paste with one half cupful boiling water. Add the remainder of the water, and boil for two minutes. Turn into scalded milk, and beat for two minutes with a dover egg-beater so as to raise a froth and prevent scum.

Milk toast

Heat the milk gently until bubbles begin to gather at the edge of the saucepan. Add a bit of butter, and salt to taste. Pour over delicately toasted bread or crackers in a hot dish, and serve steaming hot. Children like cracker toast slightly sweetened.

Cream toast

Dip thin slices of toasted bread quickly into boiling salted water, and then pour over them thin white sauce, very hot.

White sauces

Thin sauce.— For vegetables, soups, and the like

1 cupful milk
1 tablespoonful butter
Few grains pepper
1 tablespoonful flour
¼ teaspoonful salt

Medium sauce.— For omelets and the like

1 cupful milk
2 tablespoonfuls butter
Few grains pepper
2 tablespoonfuls flour
½ teaspoonful salt

Thick sauce.— For croquettes and the like

1 cupful milk
3 tablespoonfuls butter
Few grains pepper
3 to 5 tablespoonfuls flour
½ teaspoonful salt

White sauce may be made by either of the following methods. It is a good plan to make a quart or more at a time, to be used as it is needed. In a cold place it will keep for several days.

1. Melt the butter in a saucepan, stir in the flour and seasoning, and let the mixture cook gently for one minute, taking care not to brown it. Add the milk gradually, stirring constantly. When all the milk has been added, let the whole boil for two minutes.

2. (A quick method for large quantities.) Heat most of the milk in a double boiler, and add the butter. Reserve a little cold milk to blend *smoothly* with the flour, salt, and pepper. Add this mixture to the heated milk. Stir until it thickens, and allow the whole mixture to cook for ten minutes or longer.

Creamed potatoes

Reheat two cups cold boiled potatoes, cut into dice, in one and one quarter cup thin white sauce.

Potatoes, macaroni, and other vegetables au gratin

Put the vegetables, with one and one quarter cup of thin white sauce, in a buttered baking dish, cover with buttered crumbs, and bake on the center grate until the crumbs are brown. Grated cheese may be sprinkled in alternate layers with the vegetable if desired.

Egg vermicelli

To two cupfuls well-seasoned, medium white sauce add the finely chopped whites of four hard-cooked eggs. Cut four slices toasted bread diagonally across, arrange on a platter, pour over them the sauce, and sprinkle with the yolks of the eggs forced through a strainer. Garnish with toast points and parsley.

When time is precious, the whole egg may be chopped and mixed with the sauce; or the eggs may be sliced and piled on the toast, and the sauce may be poured over them.

Swiss potato soup

4 small potatoes
1 large flat white turnip
3 cupfuls boiling water
1 quart scalded milk
Cayenne pepper
½ onion
4 tablespoonfuls butter
⅓ cupful flour
1½ teaspoonful salt

Wash, pare, and cut potatoes in halves. Wash, pare, and cut turnip in one-fourth-inch slices. Parboil together for ten minutes, drain, add the onion cut in slices, and add three cupfuls boiling water. Cook until the vegetables are soft; drain, reserving the water to add to the vegetables after rubbing them through a sieve. Add the milk, reheat, and bind with butter and flour cooked together. Season with salt and pepper.

PROTEIN IN THE DIET

I Like carbohydrates and fats, protein yields heat when consumed in the body; but it is too expensive to be considered simply as a source of energy.

II Protein, therefore, should be included in the diet mainly as a source of nitrogen, the most important constituent of that living, working cell-material, called protoplasm, which is the ground substance of every plant and animal cell.

III Some simple animals and plants consist merely of a mass of protoplasm protected by a delicate membrane or wall. These single-celled organisms can use oxygen, and feed, digest, grow, and reproduce their kind as completely as human beings can. The controlling part of the cell is a slightly thickened mass of modified protoplasm, called the nucleus.

IV The higher animals and plants are made up of millions of cells, large groups of which in animals are sufficiently modified to serve such diverse purposes as those of support, locomotion, digestion, removal of waste, and reproduction. The ground substance of each of these cells, however, is protoplasm, which must be built up and repaired by the protein, or nitrogenous part, of the daily food.

V Some protein is therefore present in every natural food, but the best sources are milk, cheese, eggs, meats and fish, legumes, cereals, and nuts. Of these, the dried legumes are the cheapest sources of protein, but not always the ones most easily managed by the body.

VI The digestion of protein begins in the stomach and is completed in the intestine. The waste products of the nitrogenous part are carried off in the urine. An excess of protein clogs the system with undesirable waste products and overburdens the kidneys.

VII The protein of milk, eggs, and cereals is believed to be freer from irritating products than is the protein of meats, and is therefore believed by many to be the best protein for young and growing children and for persons in delicate health.

VIII In contrast to the amount of energy material used daily by the body, the amount of protein used as repair material depends not so much on the amount and kind of work being done as on the amount of muscular tissue present, roughly judged by its weight. The average adult probably needs two to three and three tenths ounces (60 to 100 grams) of protein a day.

IX A growing child needs more food of every kind in proportion to his weight than an adult needs, but no more protein in proportion to the fuel-value of his food than the adult needs.

The cooking of meat

I Meat is the muscular tissue of the animal body. It consists of elongated cells, or muscle fibers, containing a cell juice (not blood) which is fluid at body temperature. These fibers are bound to one another, and into successively larger and larger groups, by connective tissue.

II The more the muscle is used, the longer do the muscle fibers become, the richer and better-flavored is the juice, the stronger is the connective tissue, and consequently the tougher is the cut.

III Intense heat (boiling temperature or above) shrinks up and toughens the muscle tubes, solidifies the juice, and temporarily shrinks and toughens the connective tissue. If long enough continued, however, intense heat will finally soften the connective tissue. If the heat is dry, as in baking and roasting, the shriveling and shrinking of all tissue continues as long as heat is applied. It is for this reason that tough pieces of meat, containing as they do much connective tissue, are not suitable for baking, roasting, or broiling. At the baking temperature strongly flavored substances of a stimulating nature are developed.

IV Moderate, moist heat, as in simmering or cooking below the boiling point of water, swells and softens the connective tissue and changes it finally to gelatin. A gelatinous material is also obtained by long, slow cooking of bone and of gristly substances.

V In order to draw out all possible nourishment from meat, as for soup, cut the meat into small cubes, soak for one half hour in salted water, and then bring slowly to a boil and simmer gently until the connective tissue is dissolved and the gelatinous material is drawn from the bones and the gristle. The residue (soup meat) consists of partially emptied muscle tubes. It has some food value, but little flavor. Season highly, and use as hash or croquettes with a sauce. Only the toughest cuts are used for soup-making.

VI If the meat is tender and we wish to retain all possible nourishment, the surface of the meat is seared by intense heat; thus the escape of the muscle juices is prevented and a high flavor is developed. The whole is then cooked more slowly, so as to soften the connective tissues and partially solidify the juices. Broiling, pan broiling, roasting, and frying are examples of this method of treating meat.

VII With moderately tough cuts, the first two methods may be combined. The surface is seared with boiling water or in a hot pan; then the meat is simmered or steamed in a covered dish until it is tender. Flavor is developed, and a large part of the juice is retained but some is drawn out into an appetizing gravy. Stewing, pot-roasting, braising, and cooking in a casserole are the methods employed. The last is particularly successful with round or flank steak. Tough steaks may be chopped or pounded, and then treated as tender cuts.

VIII The fireless cooker is excellent for cooking meat stews.

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Suggested recipes for the cooking of meats

Broiled beefsteak

Steaks should be cut at least an inch thick. The flank end of sirloin steak may be removed before cooking if desired. It may be put in the soup kettle, or the lean part may be chopped and utilized for meat cakes and the fat tried out and clarified for shortening.

Wipe the meat with a cloth wrung out of cold water, and trim off superfluous fat. Grease a wire broiler with some of the fat, place the meat in the broiler (having the far edge near the handle), and broil over a clear fire, turning every ten seconds the first minute so that the surface may be well seared and the juices prevented from escaping. After the first minute turn the meat occasionally until it is well cooked on both sides. Steak cut one inch thick will require broiling for five minutes if it is preferred rare; six minutes if well done. Remove it from the broiler to a hot platter, spread with butter, and sprinkle with salt and pepper.

Broiled hamburg steak

Chop finely lean, raw beef, shape it round or oblong, one inch or more thick. Handle the meat gently, for if pressed compactly it will be too solid. Place in a well-greased broiler, and continue as for broiled beefsteak.

Chopped meat may be pan-broiled in small cakes; it may be highly seasoned and mixed with bread crumbs and egg, and pan-broiled; or it may be made into an appetizing loaf, steamed in buttered paper, and served with brown gravy or tomato sauce.

Pan-broiled lamb chops

Loin chops for pan-broiling should have most of the fat removed and the flank skewered in order to make them round like a small steak. Wipe the chops and place them in a hissing hot frying pan. Turn as soon as the under surface is seared, and sear the other side. Turn often, using both knife and fork so that the surface may not be pierced. Cook for six minutes if liked very rare; for eight or ten minutes if preferred well done. Let stand around the edge of the frying pan in order to brown the outside fat. When done, sprinkle with salt and pepper and dot with butter. Place on a hot platter and let stand in a warm oven a few moments before serving.

Beefsteak may be pan-broiled by the same method.

Pork chops

Wipe the chops, trim off all fat, and brown both sides in an ungreased, hissing hot frying pan. Remove the partly cooked chops, and caramelize a little sugar in the same pan until it turns dark brown. Add enough boiling water to make the gravy; season with salt, pepper, onion juice or onion salt, and a tiny piece of bay leaf; thicken with flour and water smoothly blended. Stewed and strained tomato or tomato extract makes a palatable addition to this gravy. Return the chops to the pan and let them simmer in the gravy, closely covered, until they are thoroughly cooked through. Serve on a hot platter.

The fat that has been trimmed off may be tried out and made into lard.

Roast beef

Trim and clean the meat if need be. Wipe with a damp cloth. Sprinkle with salt and pepper and dredge the meat and the pan with flour. Place on the rack in the roasting pan.

Put the meat into a very hot oven for five minutes or until the flour begins to brown in the bottom of the pan; reduce the heat somewhat, and cover the bottom of the pan with boiling water. Roast, allowing fifteen minutes for each pound (plus fifteen minutes for the heat to penetrate if the roast is more than four pounds). Baste often with the water in the pan. Keep the bottom of the pan covered, adding more water if it is needed.

When the roast is done, it should be brown over the entire surface and to a depth of one quarter inch. The interior should be uniformly red. Place the roast on a hot platter. Remove string and skewers. Thicken the liquid in the roasting pan, using one tablespoonful flour mixed with a little cold water for each cup of liquid. Boil for two to three minutes and strain. Season well. Serve hot.

Brown gravy

Pour off very carefully almost all the fat in the baking pan, retaining all the browned pieces of meat. To these add three quarters tablespoonful flour, mix well, and brown a little. Next add one cupful boiling water. Stir until the mixture boils, and let cook two to three minutes longer. Season with salt and pepper. Strain the gravy into a gravy dish, and serve hot.

Beef stew

3 pounds beef
1 turnip
1 onion
6 potatoes
Salt and pepper
3 carrots
Cold water to cover
1 tablespoonful flour for 1 quart liquid

Cut the beef into one-inch cubes and brown in the fat. Place the beef in the saucepan, cover with water, and bring slowly to the boiling point. Reduce the temperature, and simmer for two hours or until the meat is tender. Wash, pare, and cut the vegetables into cubes. Add them half an hour before the meat is done; then season and thicken the stew.

Lamb stew

1½ pounds breast of lamb
1 pint boiling water
4 potatoes
1 slice onion
2 tablespoonfuls rice
1 cupful strained tomatoes or
1 tablespoonful catsup

Brown the onion in a little fat in a saucepan. Sprinkle the meat with pepper and salt, add the onion and the water, heat to the boiling point, and let simmer directly over the heat for two hours or until the meat is tender. After one half hour of simmering add the rice. Half an hour before serving add the potatoes cut in cubes. Add catsup, and serve.

Irish stew

Wipe and cut in pieces three pounds lamb from the fore quarter. Place in a kettle, cover with boiling water, and cook slowly for two hours or until tender. After cooking for one hour, add one half cupful each of carrots and turnips cut in one-half-inch cubes and one onion cut in slices; fifteen minutes before serving add four cups potatoes cut in one-quarter-inch slices, previously parboiled for five minutes in boiling water. Thicken with one quarter cupful flour, diluted with enough cold water to form a thin, smooth paste. Season with salt and pepper.

This rule may also be adapted for the fireless cooker.

Shepherd's pie

Chop cold meat to a fine mince, season with salt and pepper, and moisten with a rich brown gravy. Prepare some hot mashed potatoes. Fill a baking dish with alternate layers of meat and potato, having the last layer of potato. Over the meat layers put two to three tablespoonfuls of gravy; over the potato dot small pieces of butter. Place in a moderate oven until brown on top.

Meat croquettes

2 cupfuls cold meat
1 teaspoonful salt and ¼ teaspoonful pepper
1 teaspoonful chopped parsley
1 beaten egg
¾ cupful brown sauce
Bread crumbs
Dust of nutmeg

Mince the meat fine. Make the sauce hot (not boiling), add meat, parsley, nutmeg, salt and pepper, and mix well. Turn out on a plate, divide into twelve equal parts, and leave to cool. When cool shape into balls, pyramids, or oblongs, brush with beaten egg, coat with bread crumbs, and fry in fat hot enough to brown a cube of bread in thirty seconds, or in fat that will brown the bread in forty seconds. Drain thoroughly. One cupful of mashed potatoes may be added to the mixture, if desired.

Brown sauce

1 tablespoonful butter
2 tablespoonfuls flour
1 cupful stock
½ teaspoonful salt and ⅛ teaspoonful pepper

Melt the butter in a saucepan, add flour, and cook until of a nut-brown color. Stir in stock and boil for three minutes. Season to taste.

Salmon croquettes

1¾ cupful cold flaked salmon	Few grains cayenne
1 cupful thick white sauce	1 teaspoonful lemon juice

Add sauce to the salmon, then add seasonings. Spread on a plate to cool. Shape, dip in crumbs, egg, and crumbs again. Fry in deep fat and drain. The fat should be hot enough to brown a small cube of stale bread golden brown in forty seconds.

Veal loaf

Wipe three pounds of lean veal, and remove skin and membrane. Chop finely or force through meat chopper; then add one half pound fat salt pork (also finely chopped), six common crackers (rolled), four tablespoonfuls cream, two tablespoonfuls lemon juice, one tablespoonful salt, one half tablespoonful pepper, and a few drops onion juice. Pack in a small bread pan, smooth evenly on top, brush with the white of egg, and bake slowly for three hours, basting with one fourth cup pork fat. Prick frequently while baking so that the pork fat may be absorbed by the meat. Cool, remove from the pan, and cut in thin slices for serving.

Eggs — another protein food

Soft-cooked eggs

Use one pint boiling water for each egg. Lower the eggs into the water by means of a tablespoon. Set the saucepan where the water will keep hot but will not boil, and let the eggs remain in the water for eight to ten minutes. Remove from the water, and serve in a cup or in the shell.

Hard-cooked eggs

Follow the directions for soft-cooked eggs, letting them remain in water just below the boiling point for forty-five minutes.

Poached eggs

Place a buttered muffin ring in a saucepan of boiling salted water. Break an egg into a saucer, being careful not to break the yolk. Slide the egg into the ring, and reduce the temperature of the water to a point just below boiling. The water should just cover the egg. When the white is set, remove the egg and serve on buttered toast.

Scrambled eggs

1 egg
1 teaspoonful butter
Salt and pepper
1 tablespoonful milk, cream, or water

Beat the egg gently with a fork, and add the liquid, salt, and pepper. Heat the butter in a smooth frying pan, and add the egg. Stir constantly until the egg is of a soft, creamy consistency throughout; the last of the cooking should be done by the heat of the pan. Serve at once.

Puffy omelet

1 egg
1 teaspoonful butter
1 tablespoonful water
Salt and pepper

Have all the utensils ready first, even to the plate on which the omelet is to be served.

Beat the yolk until it is light-colored and thick. Add water, salt, and pepper. Mix thoroughly. Add the white of the egg, beaten until stiff and dry, folding it in gently. Melt the butter in a smooth omelet pan, turn in the mixture, and spread it evenly over the pan. Let it stand for about two minutes where there is moderate heat, then set it in the oven so as to cook the top slightly. As soon as a knife thrust into the center of the omelet comes out nearly clean, remove from the oven, cut across the center of the top at right angles to the handle, fold the part nearer the handle over the other part, and turn it out on a hot plate.

Serve by itself or with a medium white sauce. Tomato sauce may also be used. If desired, the omelet may be sprinkled with sugar, grated cheese, chopped ham or chicken, asparagus, or any suitable filling just before folding.

Home preservation of eggs

It is desirable for the household to obtain a supply of eggs during the season when they are of good quality and plentiful, place them in some good homemade preservative, and have them for use during the winter months. Several methods of preservation have been tried. Some of these methods are the following: packing in dry table salt, bran, oats, or sawdust; preserving in dry wood ashes, salt brine, slaked lime and salt brine, limewater, different solutions of water glass; or covering with vaseline, paraffin, patented preparations, butter, or lard. Of all these methods of preservation, the limewater and salt brine and the water-glass solution seem to give the best results. The water glass gives the better results of the two because eggs preserved in the limewater and salt brine have a chalky taste.

Water-glass solution

Water-glass solution may be obtained from any drug store at a cost of twenty to thirty cents a quart. Mix one and one half quarts of this solution with eighteen quarts of pure water; water that has been boiled is preferable. Stir these until they are thoroughly mixed. A stone jar is the most suitable vessel for the mixture. Two eight-gallon jars are sufficient for thirty dozen eggs, with the amount of solution prescribed. After the water glass is thoroughly mixed, divide it into the different vessels to be used, being sure that the vessels are absolutely clean. Place the eggs in the water glass, see that the top eggs are covered by at least two inches of the liquid, and cover the jars in order to prevent evaporation. Put them in a cool place, where they will be undisturbed during the year.

Suggestions on preserving eggs

Preserve only absolutely fresh eggs. Stale eggs will not keep in any preservative. Have your preservative ready to put the fresh eggs in as you get them. If you are in doubt as to their freshness, candle them.

Do not preserve dirty eggs or eggs that have been washed. The washed eggs will not keep because the shell has been moistened, and the dirty eggs will become tainted in flavor.

Do not use the same liquid preservative more than one year.

Spring eggs will keep better than summer or fall eggs.

Rinse the eggs with water after removing them from the water glass.

Do not leave eggs in the water glass longer than one year.

Eggs that are in good condition when removed from the water glass will usually remain good for at least two weeks.

Water-glass eggs are practically as good as fresh eggs for cooking purposes. If it is desired to boil them, prick a small hole through the large end of the shell before placing them in the water. The pores of the shell have been sealed with the water glass, and without this pinhole the air expanding within the shell will burst it.

MINERAL MATTER IN THE DIETARY

I Mineral matter, sometimes called mineral salts or ash, is of great service to the body.
  (a) It is built up into tissues, such as bones, teeth, muscles, nerves, and red blood corpuscles.
  (b) It helps to regulate many important body processes, such as digestion, excretion, and the carrying of oxygen to the tissues; it helps to maintain the neutrality of the blood; it stimulates tissue activity.

II Like protein and water, mineral matter occurs in all natural foods.

III Lime.—

(a) Lime forms a large part of the weight of bones and teeth and is important in the fluids of the body.

(b) An insufficient supply of lime results, especially in children, in weak, spongy bones, poor teeth, and a general tendency to anæmia and rickets.

(c) The following foods are particularly valuable as sources of lime: Milk (one quart supplies enough lime for a full-grown man for one day), skimmed milk, buttermilk, cheese, molasses, figs, whole cereals, legumes, oranges, spinach; fruits and vegetables in general; and to some extent naturally hard water.

IV Phosphorus.—

(a) Phosphorus is built up into the bones, into the nuclei of all cells, and into the nerve tissue. Certain vegetable phosphorus compounds stimulate the activity of the intestinal muscles, and thus are important aids in the elimination of waste matter from the bowels.

(b) A poverty of phosphorus compounds may result in weak bones, stunted or retarded growth, and constipation.

(c) Phosphorus is found in protein foods, such as milk, the yolks of eggs, meats, fish, whole cereals, whole-meal flours, nuts, and legumes; and in spinach, potatoes, dried fruits, onions, and other vegetables.

V Iron.—

(a) Iron enters into the composition of the nucleus of the cell and into that part of the red blood corpuscles which carries oxygen. Growing children, women, and expectant mothers especially, need a diet rich in iron.

(b) Poverty of iron may result in stunted or retarded growth, or in anæmia. Symptoms of anæmia are pale cheeks, lips, and ears, general listlessness, and a lack of muscular tone. Adenoids, closing the air passages of the nose, may shut off the supply of oxygen sufficiently so as to cause a condition of body-poisoning somewhat similar to that resulting from anæmia.

(c) Foods rich in iron are: spinach, red meats, egg yolks, legumes, whole cereals, whole-meal flours, dried fruits, oranges, succulent fruits and vegetables.

VI Meat, fish, chicken, eggs, and whole cereals, after having been used in the body, leave irritating acid substances in the blood. Fruits, vegetables, and milk leave bases, or alkaline substances, in the blood, which, if taken in sufficient quantity, counteract these acids and change them to harmless compounds which the body then throws off. There should therefore be in every dietary a balance between the acid- and the alkali-yielding foods.

VII The housekeeper should plan:

- (a) To include generous quantities of milk, eggs, fruits and vegetables, and whole cereals in the diet.
- (b) To have the garden planted early, and to see that a variety of vegetables is raised, including spinach.
- (c) To arrange for canning perishable fruits and vegetables and for suitably storing the others.
- (d) To cook and serve vegetables temptingly and to see that they are eaten by as many members of the family as possible.
- (e) To satisfy at least a part of the children's natural craving for sweets by the use of dried or preserved fruits, especially figs and prunes.

VIII Suggestions for avoiding constipation:

- (a) Form and maintain regular habits of moving the bowels; train the children while they are very young.
- (b) Drink plenty of water.
- (c) Avoid too greatly concentrated a diet; use fruits and vegetables freely, for their mineral matter and bulk.
- (d) Avoid digestive disturbances.
- (e) Strengthen the abdominal muscles by systematic exercises.

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Vegetables

General directions for cooking

Wash thoroughly in cold water, using a vegetable brush for the purpose.

In paring, use a sharp French vegetable-knife. Remove the outer skin and any discolored parts of the vegetable.

Cook in boiling water. Salt at the end of ten minutes, using in general one teaspoonful salt to one quart boiling water.

Sweet-juiced vegetables, such as peas, beans, potatoes, and squash, should be cooked closely covered in a small quantity of water, so as to avoid loss of flavor by evaporation.

Strong-juiced vegetables, such as cabbages, onions, and turnips, should be cooked in a large quantity of water in an uncovered vessel. If the flavor is very strong, these vegetables should be cooked in two or more waters.

Time for cooking varies with the freshness and type of vegetable, so that a time-table for cooking vegetables can serve only as a guide. In general the following time-table may be followed:

Green vegetables, 15 to 30 minutes.
Roots [2] and tubers, 30 minutes to 1 hour.
Legumes (dried), 1 to 3 hours, after thorough soaking.

Scalloped cabbage

2 cupfuls cooked chopped cabbage
1 cupful medium white sauce
⅓ cupful grated cheese
½ cupful buttered crumbs

Melt the cheese in the sauce, add the cabbage, put into a baking dish, and cover with buttered crumbs. Brown in the oven.

Buttered crumbs

Use two to three tablespoonfuls butter to one cupful crumbs. Melt the butter, add the crumbs, and mix together until all the crumbs are coated with butter.

Creamed carrots

Wash the carrots, and scrape to remove the skin. Do not peel, because the brightest color and best flavor are near the surface. Cut into slices or cubes, and cook in a small quantity of boiling water with the cover on the pan. Boil until tender. There should be little if any water to drain from the carrots after they have been cooked.

Add the carrots to medium white sauce made of equal parts of milk and carrot water. One cupful carrots should be used to one half cupful sauce.

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[2] Old beets, cook for three hours; but they never become really tender.

Creamed celery

1 cupful celery cubes	Salt
Boiling water	½ cupful medium white sauce

Wash and clean the celery, cut into one-half-inch pieces, and boil in a small quantity of water until tender (about thirty minutes). Salt at the end of ten minutes. When tender, drain off the water and pour over it the hot white sauce.

Celery soup

For this soup, use the water in which the celery has been boiled, twice as much milk as water, one teaspoonful flour, and one teaspoonful butter to each cupful of liquid; salt, pepper, and celery salt if desired.

Proceed as in making white sauce.

Onion soup

Slice four large onions; put them in one cupful cold water and boil for twenty minutes; then drain. Melt in a saucepan one tablespoonful butter, add onion, and cook slowly for three minutes. Sprinkle in one tablespoonful flour, and stir until brown; then add one and one half quarts hot water, one half teaspoonful salt, pepper, and one ounce beef extract (1 tablespoonful). Cook slowly with cover on saucepan for twenty minutes. Strain into cups in which there has been placed a round of toast covered with grated cheese.

Fruits

Oranges

1. Wipe the orange, and cut it in halves crosswise. Place one half on a fruit plate, with an orange spoon or a teaspoon at the right of the place.

2. Peel an orange, removing as much of the white membrane as possible. Remove pulpy sections (this may be done by using a sharp knife and cutting the pulp from a tough piece on one side of the section and then on the other). Arrange the sections in a glass dish or a fruit plate around a mound of powdered sugar. Remove any seeds.

3. Cut through the skin only, so as to leave an inch band around the center. Remove the caps, saving them if for a box luncheon, but if for breakfast cut away the peel, scoring it in several places. Remove all thick white membrane. Sever the band at the junction of the two sections, and separate the sections from one another, leaving all attached to the band.

Grapefruit

Wipe a grapefruit and cut in halves crosswise. With a small, sharp-pointed knife make a cut separating the pulp from the skin around the entire circumference; then make cuts separating the pulp from the part that divides the fruit into sections. Remove the tough part in one piece (this may be done by cutting with scissors at stem and blossom ends close to the skin). Sprinkle the fruit pulp left in the grape fruit with powdered sugar. Let stand for ten minutes, and serve very cold. Place on a fruit plate and garnish with a candied cherry.

Stewed prunes

- ½ pound prunes
- ½ lemon or 1 orange (sliced)
- 1 cupful sugar

Wash and soak the prunes for six hours in enough water or sweet cider to cover them. Add the sugar and the lemon to the water, and cook for thirty minutes. (Omit the sugar and the lemon with cider.)

Baked apples

Select apples of an even size. Wash; remove the core, but leave the blossom end; fill the cavity with sugar. Cut a circle through the skin of the apple, extending all the way around so as to allow the steam to escape. Place apples in a baking dish and add enough hot water to cover the bottom of the dish; bake until the apples are tender, basting every ten minutes.

Baked apples may be canned by packing them in wide-mouthed sterilized jars. The jars should then be filled to overflowing with boiling sirup.

Stewed figs

Use pulled figs if such are obtainable. Look them over carefully and scrub with a brush. Soak for several hours or over night in a little water. Make a thin sirup of the water in which the figs were soaked, using one quarter cupful sugar for each cup of water and boiling for ten minutes. Cook the fruit gently in this sirup until soft, but not broken; then, if desired, remove, and boil the sirup alone until it is thick and sweet. Pour over the cooked fruit, and cool. For dessert, serve very cold with thick cream. For breakfast, have the sirup thinner, and flavor with a bit of grated orange peel; serve without cream.

Stuffed figs

Use new-pulled figs. Scrub well, and steam in a double boiler for half an hour with the water that clings to them after washing. Cool in a covered dish; then make a slit at one side and press in a fresh marshmallow and a nut meat. Draw the sides together, and roll the whole in equal parts of cornstarch and powdered sugar. Use these for box luncheons and afternoon teas.

Jellied prunes

Wash the prunes well. Soak for one hour and cook in the top of a double boiler with very little water in the bottom until the fruit is thoroughly soft. The prunes will swell, and the rich juice will jelly. Serve cold.

Steamed dates

Wash the dates carefully, put in the top of a double boiler, and steam for fifteen or twenty minutes, using only the water that adheres to the fruit after washing. This freshens the dates wonderfully. Much the same effect is obtained by gently warming well-washed dates for a few minutes in a covered bowl set in a moderate oven.

Stuffed dates

Wash the dates, and steam them. When cool, make a slit in one side and fill the cavity with nut meats or with cream or dairy cheese or peanut butter. Roll them in granulated sugar if desired. Use these dates once in a while for the luncheon basket, instead of cake or pie.

Apricot dessert

Look the fruit over, scrub with a brush, and soak for one half hour in tepid water. Drain, renew the water, and soak for three or four hours or over night. Cook until soft in the water in which they were soaked, and add sugar to taste. Stir until the sugar is dissolved; then mash through a strainer and chill. Mix with the beaten white of egg or with whipped cream. Serve in glass cups, with a spoonful of sweetened whipped cream on top.

Salads and salad dressings

I Well-made salads satisfy the normal craving of the system for vegetable acids more healthfully and more effectively than do pickles. Where vinegar cannot safely be used, lemon juice is a satisfactory substitute.

II The charm of lettuce, celery, cabbage, and other green vegetables used for salad, lies mainly in their crispness and succulence.

III Wash and rinse the lettuce, leaf by leaf; wrap in damp cheesecloth, and lay in a cold place that it may become crisp. Wash the celery, remove stained parts and coarse strings, and cut in one-third-inch pieces. Shred or finely chop the cabbage. Celery and cabbage should be soaked in cold water for half an hour, after which, like lettuce, they may be set away in a damp cheesecloth. All salad vegetables should be carefully dried before using.

IV It saves time to make up a quantity of salad dressing at a time, for use as it is needed.

V Vegetables, fruits, and meats that are to be served with an oil dressing are improved by being *marinated*, that is, by mixing them with a little French dressing and allowing them to stand for half an hour before being used. Vinegar softens the tender cell fiber of the lettuce leaf, causing it to wilt. Lettuce, therefore, should not be marinated, but should be added just before the salad is served.

Boiled dressing in quantity

1½ cupful milk
2 eggs slightly beaten
4 tablespoonfuls sugar
2½ teaspoonfuls mustard
½ cupful vinegar
2 teaspoonfuls salt
3 tablespoonfuls melted butter
1½ tablespoonful flour
Cayenne pepper

Mix the dry ingredients, and blend with them one quarter cupful of milk. Heat the remainder of the milk to boiling, add the butter, thicken with the first mixture, and boil for two minutes. Add the vinegar slowly, and pour this hot liquid cautiously over the slightly beaten egg, stirring constantly. Cook over hot water until it thickens. Cool immediately in order to prevent curdling, and pour into a scalded glass jar. This rule makes more than a pint of rather mild dressing, which will keep for a long time in a cold place.

Quick mayonnaise

1 cupful olive oil
Yolk of 1 egg
2 tablespoonfuls vinegar or lemon juice
Few grains cayenne
⅔ teaspoonful powdered sugar if desired
⅔ teaspoonful salt
⅔ teaspoonful mustard

If onion flavor is desired, rub a bowl with a freshly cut onion or a clove of garlic. Put in the seasonings, mix well, and beat in the egg yolk until the whole is well thickened. Add gradually the entire amount of acid, still beating.

Now begin to add the oil, at first by teaspoons, beating with the dover beater after each addition. Presently the oil may be added in larger quantities. When all has been used, add any further necessary seasonings and beat thoroughly. Cover the bowl with an earthen dish, and keep in a cool place until it is needed.

French dressing in quantity

1 cupful olive oil
¼ to ⅓ cupful vinegar
1½ teaspoonful salt
1 teaspoonful mustard
1 teaspoonful paprika

Place a small funnel in the neck of a good-sized glass bottle, preferably with a ground-glass stopper. Add first the dry ingredients, next the vinegar, and finally the oil. Remove the funnel, cork the bottle, and shake vigorously until the dressing is well thickened. Pour off what is wanted, recork the bottle, and set away in a cold place. Shake well each time before using.

Vegetable salads

Left-overs of cooked peas, beans, cauliflower, beets, turnips, carrots, and cold boiled potatoes may be utilized, either separately or several together. Free them if necessary from sauce or butter by rinsing quickly in warm water and drying well. If an oil dressing is to be used, moisten the vegetables well with French dressing and let them stand for half an hour in a cold place. Serve on beds of lettuce leaves, finely shredded crisp cabbage, or well-washed celery tips, with a generous spoonful of dressing over the whole. Use French, mayonnaise, or boiled or cream dressing, as preferred.

Fish salad with rice

Remove bones and skin from the contents of one can of salmon or tuna fish, or from cold boiled codfish, and mince finely. Add an equal amount of cold boiled rice and season with salt, pepper, and vinegar. Stir in plenty of salad dressing, and set away for a while in a cold place. When ready to serve, add a little crisp celery finely cut or a few chopped nasturtium stems, and shape in molds moistened with cold water. Turn out on a plate of lettuce leaves, crisp shredded cabbage, or celery tips; garnish with a spoonful of dressing and with stuffed olives cut lengthwise, or with nasturtium blossoms and leaves.

Mock-chicken salad

Cut cold roast fresh pork, free from fat, into small cubes; mix with it an equal quantity of cold boiled rice or of finely cut celery, and proceed as for fish salad.

Tomato and fig salad

Wipe and peel small ripe tomatoes; cut in eighths; mix with half the amount of figs cut in pieces and a quarter the amount of pecan nuts. Serve with mayonnaise dressing in nests of crisp lettuce leaves, or the tomatoes may be left whole and filled with fig and nut mixture.

Waldorf salad

1 cupful cubed apples	½ cupful nut meats
1 cupful cubed celery	6 red apples (medium-sized)

Wash the apples and cut a small slice from the top of the red ones. Scrape out the core, cut out the pulp in as large pieces as possible without injuring the outside skin, and rub the pieces of apple with a piece of lemon to keep them from discoloring. Wash and scrape the celery, cut it in cubes, and place in a bowl; next cut the nut meats in small pieces and lay on the celery; lastly cut the apples in cubes. Mix together lightly, and fill the cavity in the red apples; place a tablespoonful of mayonnaise on each, and serve on lettuce.

Cheese and nut salad

Cut fresh cream or domestic cheese in tiny cubes. Mix with it about twice its bulk of finely cut celery and some broken nut meats. A few raisins, cut in half, cut figs or dates, or a little chopped green pepper or sliced cucumber pickle, may be added if desired. Serve on lettuce leaves or shredded cabbage, with a generous spoonful of dressing. Marinate if an oil dressing is to be used.

Frozen tomato salad

Open a one-quart can of tomatoes, turn from the can, and let stand for one hour that they may be reoxygenated. Add three tablespoonfuls of sugar and season highly with salt and cayenne; then rub through a sieve. Turn into one-half-pound breakfast-cocoa boxes, cover tightly, pack in salt and ice, using equal parts, and let stand for three hours. Remove from the mold, arrange on lettuce leaves, and serve with mayonnaise dressing.

Cabbage salad in beet cups

6 medium-sized beets	1 cupful chopped cabbage
1 lettuce	1 cupful chopped celery
1 tablespoonful horse-radish	$\frac{3}{4}$ cupful French dressing

Boil the beets in salted water until perfectly tender. Scrape out the center, and trim until perfectly round. Mix the celery, cabbage, horse-radish, and dressing lightly together. Fill the cavity in the beets, and serve on lettuce or decorate with parsley or water cress.

PLANNING MEALS

The material on which this lesson is based is found chiefly in the Reading-Course lessons cited below as references. A few additional suggestions may be given as follows:

I Put down in black and white the number of persons in your family, noting the age, size, occupation, and general health of each person. This requires you to state to yourself the conditions that you have to keep in mind in feeding them.

II Do not try to balance any one meal. Strive rather for a practical balance of the food of two or three days at a time.

III Do not serve too great a variety at a single meal. A few well-chosen, well-seasoned, and attractively served dishes will be more thoroughly appreciated than a large variety can possibly be.

IV Secure variety by the careful planning of successive meals. Avoid serving the same food combinations on the same day in successive weeks.

V Variety and balance are best achieved by planning out on paper the meals for several days or for the entire week and then criticizing them as a whole as to their content of building, energy-giving, and regulating materials.

References

Rules for planning the family dietary. Cornell reading-course for the farm home, Vol. V, No. 41.

Cost of food. Cornell reading-course for the farm home, Vol. II, No. 29.

The box luncheon. Cornell reading-course for the farm home, Vol. II, No. 43.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

W. A. STOCKING, JR., *Acting Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 57 FEBRUARY 1, 1914 **FOOD SERIES No. 11**

A SYLLABUS OF LESSONS FOR EXTENSION SCHOOLS IN HOME ECONOMICS

DISCUSSION PAPER

Extension schools have been emphasized in the plans of the Department of Home Economics because the need for and value of a period of continued study, as compared with the occasional informational lecture of the past, is clearly and generally recognized; not that the separate lecture has any less value than formerly, but because farmers' wives desire more comprehensive and thorough instruction in household subjects.

Please write the answers to these questions and return this paper to the Department of Home Economics, New York State College of Agriculture, Ithaca, New York.

1. What can the Department of Home Economics at the New York State College of Agriculture do in your community to establish more instruction in the subjects in which the housewife needs assistance?

2. What encouragement does the housewife of your community now receive to interest her in scientific methods of housekeeping?

3. Is there instruction in the public school in your neighborhood that will give your daughters a knowledge of housekeeping?

4. What means of earning money at home is offered to the girls in your community?

5. If you could choose the subject that you would like to have brought to you by means of literature, lectures, or demonstrations, what would it be?

Name..................................

Address..............................

Date......................................

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COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 59 MARCH 1, 1914 **SANITATION SERIES No. 4**

SEWAGE DISPOSAL FOR COUNTRY HOMES

Howard W. Riley

INTRODUCTION

The purpose of this lesson is to suggest to persons in country homes better methods of disposing of household wastes than by means of the slop-pail and the outdoor privy. These new methods of sewage disposal are recommended to the farmer because it is hoped that they offer the following advantages:

1. They should make conditions much easier for every one in the home, especially for the housewife.
2. They are adapted to apparatus which is kept in order by about one tenth as much work as the old ways require, and this small amount of work will be not nearly so disagreeable as that now generally necessary.
3. They are more sanitary than the old methods, preventing the possible spread of disease by flies or by the contamination of drinking water.
4. They are easy to understand, are practicable, and are reasonable in price.
5. The different plans suggested cover every type of conditions usually met with in average country homes.

Household tasks occupy the greater part of the country woman's time. They should be made as agreeable as possible and should be conducted under sanitary conditions. The emptying of the slop-pail is a disagreeable task little appreciated by those who do not have to do it. Furthermore, careless disposal of kitchen wastes will create unpleasant and unsanitary conditions near the house. Every home should therefore have in the kitchen a sink connected to a sanitary disposal system. There is no need to delay installing a sink until the time when a complete water system can be put in. A sink and a drain are cheaper than a water system, and farm women should not be permitted to be for years without such conveniences even though fresh water has to be carried in pails. A kitchen sink and a sanitary system for the disposal of waste should first be installed; a pump at the sink is the next essential; and a furnace, a bathroom, and a complete water system should follow whenever possible. The farmer should not wait for the furnace before installing a sink. If the house is one that is cold at night, the sink trap should be put in the cellar and boxed with boards, and the box should be filled with sawdust.

The cleaning of an ordinary outdoor privy is an unpleasant and unsanitary task. The care of a good earth closet is not quite so unpleasant nor so unsanitary, but in either case the disposal of the contents of the vault, box, or pail is not easy if all danger of disease is to be avoided. An arrangement consisting of a sink, a direct closet, a septic tank, and an underground purifying tile, as shown in plans B and C, a complete plumbing system as in Plan F or Plan G, or a direct closet and a chemical tank as in Plan E, is better than the earth closet. It is not necessary to wait for a furnace and a complete water system before installing equipment that is better than the isolated outdoor-closet arrangement. Such equipment as is shown in plans B, C, D, or E may be built as part of the house and reached without going out of doors.

The isolated outdoor closet is frequently the indirect cause of sickness. It is often so cold or so public that many persons do not use it as frequently as they should. Wastes retained too long in the body tend to cause sickness.

The ordinary privy is often the direct means of spreading diseases such as typhoid fever, dysentery, diarrhea, or summer complaint, and the hookworm disease of the warm southern States. In all these cases the germs of the disease are contained in the natural wastes of the body. Persons who are ill with any one of these diseases may give off countless millions of germs every day, while some persons who feel entirely well have been found to pass from their systems vast numbers of germs of some of these diseases, the most dangerous being typhoid fever. If flies have access to the contents of the privy, germs will be carried on their legs and bodies; one investigator found over four million typhoid germs on four flies. Experiments have proved that wherever these flies crawl they leave a trail of disease germs: if they crawl on cake, the germs are left there; if on a baby's rattle, the germs go into the stomach of the child. Since the flies eat the wastes in the open privy, they take disease germs into their own bodies and give them off later in the flyspecks about the house.

Another way in which disease is spread from privies is by water. Often surface leakage from unsanitary privies is carried by the rains into streams, wells, and springs. This is proved by state records which show that outbreaks of typhoid fever in the country frequently come after heavy rainstorms. In many cases underground leakage from unsanitary privies is not purified by the soil before it has proved harmful. Soil that is fine-grained and fresh will probably purify sewage in one hundred feet, but it will not do so always. If kept constantly saturated with sewage, even fine soil will in time fail to act as a purifier. It may become foul for two hundred feet or more from the closet. Coarse-grained soils do not purify so well as do fine soils, while in limestone regions water may run underground in streams for miles, unfiltered and unpurified.

This whole subject of the probability of the spread of pollution to wells is admirably discussed under the heading "Safety distance," in a bulletin known as Water-Supply Paper 255, published by the United States Geological Survey at Washington, D. C., under the title "Underground Waters for Farm Use," by Myron L. Fuller. The bulletin is for free distribution. The following extract is taken from this bulletin:

> By "safety distance" is meant the distance from a source of pollution at which a well may be sunk with a fair degree of safety. Some writers have spoken of a "cone of safety," by which is meant an inverted conical section of earth with its apex at the bottom of the well and its base a circle of some fixed radius on the surface. The radius taken by some is the depth of the well, by others twice the depth of the well, but such limits are usually fixed without taking into consideration the nature of ground-water movements or the character of the passages in which it moves. The distance of safety also depends to a considerable degree on the quantity and concentration of the pollution entering the ground water. Where coming from the surface the amount is commonly not large, but where entering at a considerable depth, as from cesspools sunk in limestone or in porous sands which also supply water to wells, it may reach the water stratum almost undiluted. It follows that no absolute radius can be laid down, each case demanding individual consideration. Certain generalizations, however, may be made as to conditions in materials of different types and under different topographic conditions, some of which are indicated below.
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> *Clay and till.*— In ordinary clay and in the pebbly or bowlder clay known as "till" the water circulates in part by general seepage through the mass, in part through relatively thin sandy layers, and in part along more or less open but irregular tubular passages. Seepage through the body of the clay or till is very slow and polluting matter is rarely carried for any great lateral distance; 100 feet from the nearest source of pollution may perhaps be regarded as a safe limit. The clay offers even more resistance to the passage ot water directly downward, a 5-foot bed as a rule effectively shutting off polluting matter from the underlying water beds, unless such matter obtains access along the break made in sinking a well or other excavation. When the water follows sandy layers the movement, though much faster than in uniform clay, is nevertheless not very rapid, rarely exceeding a few feet per day, and pollution does not often extend much over 150 feet, 200 feet usually being a safe distance. In open passages movement is much more rapid, and may amount to several hundred feet a day in extreme cases. Under such conditions there is no purification and relatively little dilution, and if the passage discharges into a well dangerous contamination may result. In a thickly inhabited region a well depending for its supply on passages of this nature is never safe.
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> *Sand.*— A bed of sand is among the safer water beds. Being of an incoherent nature, the material rarely contains open passages, the water circulating in general by a slow movement among the grains. The rate, though sometimes amounting to 50 feet or more a day, is usually under 5 feet and may be under 1 foot. A well 200 feet from the nearest point of pollution is probably safe in fine and medium sands, but in coarse sands and gravel a much greater distance may be essential.

Sandstone.— The movement of water in sandstone is in part through the body of the rock and in part through small open passages along the joint or bedding planes. Owing to the greater density of the rock resulting from the cementation of the grains the distance to which pollution may extend through the pores of the rock is less than in sand, 100 feet usually being a safe distance. Probably even with the water moving along the joints and bedding planes, 125 to 150 feet from the source of pollution is a safe distance for a well.

Slate and shale.— In slate and shale the water follows in part the planes of stratification or bedding and in part the more or less vertical joints by which these rocks are usually cut. Unless certain of the layers are sandy the movement along the bedding planes is generally slow and pollution is carried for only short distances. The joints, however, are in many places fairly open and may conduct the water within a short time to considerable distances, possibly many hundred feet . . . However, unless the examination of the rock or the behavior of the drill in the well shows the presence of such open joints, a well in slate or shale may usually be considered safe if not less than 100 feet from a source of pollution.

Limestone.— The movement of water through limestone is almost entirely by means of open passages. Some of these are only a minute fraction of an inch in width, being no wider than joint and bedding planes. In such passages the movement of water is very slow and pollution is rarely carried far, 150 feet from a possible source usually being a safe distance. Other passages, however, are of considerable size, perhaps many feet in diameter, and may extend for miles. One chamber in Mammoth Cave is nearly ten miles long, and there is evidence that similar though perhaps smaller channels exist at numerous other points. These openings are not uncommonly occupied by flowing streams which, if polluting matter is introduced, may carry it for many miles. Such streams may have connection with surface sink holes. Cornstalks and other refuse from the surface not infrequently appear in wells drawing water from limestone, and the waters are often muddy after storms. Such occurrences are indications of surface contamination and the waters should be avoided if possible.

Granite.— Practically no water passes through the body of granite, the movement being mainly along joint or fault planes or through pore spaces in the disintegrated upper portions of weathered granite masses. Polluting matter may reach to considerable distances through joint or fault planes, as is indicated by the fact that the salt water of the ocean finds entrance to some wells located 500 feet, and in places even a quarter of a mile or more, from the shore. It is said that in the deep public well sunk in granite at Atlanta, Georgia, sufficient polluting matter entered through a joint struck at 1160 feet from the surface to render the water unfit for drinking.

In the country careless methods of disposing of night soil[1] are very common, resulting in sickness and death in farm families and to strangers far away. In 1885 ignorance in the care of a backwoodsman who was ill with typhoid fever was the direct and only possible cause of a typhoid epidemic in Plymouth, Pennsylvania, in which more than one thousand persons were ill and more than one hundred died. Death, grief, and great money loss all due to one unsanitary privy!

It is not easy to kill disease germs by methods that the average farmer will consent to adopt for disposing of the night soil on his farm. Typhoid germs buried in cultivated soil will possibly be found alive and dangerous after three to six months. Experiments have shown that such germs have lived through a trip of ninety miles in river water; other experiments have proved that typhoid germs are not destroyed by the action of the rotting bacteria in the septic tank.

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[1] Night soil is one of several different terms used in speaking of the waste matter from the human body. Other terms often used by writers on this subject are "human excreta," "excrement," "dejecta," or "fecal matter."

Heat will kill disease germs in night soil if all the material is made boiling hot. In the South, where the hookworm disease prevails, the heating of night soil is to be strongly recommended. This treatment is not recommended by the writer for New York State, first, because he does not consider it necessary for a reasonably safe disposal system, and, secondly, because the process would be so disagreeable and such a nuisance that farmers would not attend to it.

Chemicals of the right kind, which are fresh and strong enough, will kill all disease bacteria with which they come in contact, but they will not kill those that they do not touch. In order to be suitable for this purpose, therefore, the chemical used must break up the solid matter in the night soil so that all particles will be reached. The chemical must also be of such a nature that it will retain its strength until the time comes for emptying the receiver. Several chemical closets are on the market, and for some cases good ones are to be recommended. Arguments in favor of their use are that they come complete and ready to set up; they are easy to install; they may be removed to new locations as plans are changed; and good ones, when properly managed, completely destroy all germ life present in their contents. Arguments against their use are the first cost, which may or may not be more than that of a septic-tank system; the steady yearly expense for chemicals, which must be bought as long as the system is used; and the frequent attention that the systems will require, since the capacity of the tanks is usually comparatively small and they must be emptied before they overflow regardless of any consideration of convenience.

TYPES OF SEWAGE-DISPOSAL SYSTEMS

A sewage-disposal system suitable to be recommended to the farmers of our northern States should, in the writer's opinion, possess the following characteristics:

1. It should be sufficiently sanitary.
2. It should be convenient for use and in its maintenance.
3. Its construction should be simple and cheap.

Outdoor closets that are apart from the house are not recommended because they are exposed to wind, cold, and the public view.

Closets placed on the surface of the ground with no receiver for the night soil are extremely dangerous, and should at once be abolished or improved.

Closets placed over vaults or pits the sides of which are not water-tight are not recommended because: (1) flies can easily reach the contents; (2) foul sewage water is constantly soaking into the lower soil and will in time spread for several hundred feet. Cracks in the rock formation may allow this water to drain even into drilled wells.

Closets with pails or tight boxes below the seats (Plan D) are better than those just discussed, but they are not to be recommended except when the persons using them are careful always to keep the contents of the pail covered with dust as a protection from flies, and when the person emptying the pails or the boxes is careful to dispose of the contents in the soil at a place where flies will not reach it, surface washing will not carry it away, and ground drainage will not lead it into water supplies.

Cesspools consisting of deep pits with loose stone walls, receiving sewage from water closets and sinks, are generally not safe, although in some cases they may be used.

From cesspools that are called good all the liquid soaks into the lower soils. As has been stated, this is dangerous except in special cases. Liquid soaks best into open soils, but it will travel farthest, and hence be most dangerous, in such soils. In heavy soils the liquid will not soak away, and the cesspool will fill up and overflow from the top as from a septic tank. The cesspool, however, will not work well as a septic tank unless it is of the right shape and the inlet and outlet pipes are arranged properly. Evidently in such cases it would be cheaper, and in all cases it would be better, to build a good septic tank in the beginning.

With the exception of plans D and E, the designs recommended in this lesson are all arranged so as to dispose of sewage in two distinct steps, according to principles that have been understood and used for years. In the first step the sewage passes very slowly through a water-tight receiver, called a septic tank, in which the solid matter settles. The clear liquid leaving the tank, called septic effluent, is purified or disposed of by some means, as will be discussed later.

THE SEPTIC TANK

The water-tight receiver, in which the sewage is held so that the solid parts will settle, is so constructed that the settlings, or sludge, will rot and be reduced in volume. This keeps the tank from filling up too rapidly.

What is usually called rotting is really the work of a kind of bacteria, which do not produce disease, but which, on the other hand, are very useful to man. They are called anaërobic bacteria, or anaërobes, because they can work only when air is kept away from them. Given suitable conditions, they will develop in large numbers in the solid matter in sewage, work in it, and break it up, turning part into gas, which bubbles up out of the water, and part into liquid, which goes on as part of the clarified sewage. It is impossible to rot the humus, which is part of the solids in sewage; therefore this humus finally settles to the bottom of the septic tank and must be removed from time to time. It is not difficult to remove such matter, as it is easily stirred with water and run through a drainpipe or a pump. If run out on the ground and dried, it will break up and crumble. It is good material for flower beds or gardens, but before being used it should be thoroughly sterilized by a generous application of chlorid of lime, or by ordinary quicklime which should be slaked with the humus while it is very wet so that the whole mass will be brought to the boiling temperature.

The humus, or digested sludge, will need to be removed from the tanks illustrated in this lesson about once in every five years. A sludge drain may be built for this purpose, as shown for the type Y tank, or the sludge may be stirred and pumped out with a thresher's tin water pump or with an ordinary pitcher pump.

The following features are essential for a successful septic tank:

Rules for the design of a successful septic tank

The septic tank is the workshop for the anaërobic, or rotting, bacteria. These bacteria will not thrive and work efficiently if the workshop is not properly planned and constructed.

1. Sewage must enter at one end of the tank and leave at the other end. This arrangement will keep the workmen in the shop constantly supplied with new material to work on, and it will also keep the shop clear of finished products. If anaërobic bacteria are allowed to become surrounded by liquid filled with chemical substances that they themselves have produced, the bacteria will not thrive, but will gradually weaken and die.

2. The flow through the tank should be slow and as uniform as possible in all parts. If the movement is not slow the solid matter will not settle. A rapid flow in the center and no movement at the sides interferes with the best working of the bacteria. Baffle boards properly placed in the tank help to maintain uniform flow, and they are provided in all concrete septic tanks shown in this lesson with the exception of the small barrel tank, which is for receiving sink water only.

3. Sewage must enter the tank and leave it from below the water level. This is an important factor, for experience has shown that the bacteria will not develop properly unless the tank is built in accordance with this requirement.

4. A rectangular tank is best made longer than its width or its depth below water level.

5. In size the tank is usually so made that it will hold a volume of water equal to the amount of sewage that will flow into it in one day.

The sizes given in this lesson have a capacity for the sludge of five years in addition to the volume of the daily flow of sewage. The writer believes that the type Y tanks illustrated in this lesson will work efficiently if they are made smaller than here specified; since this belief has not been verified by experiment, however, he has always specified sizes in accordance with the usual rules, and tanks so made are now giving satisfactory results. Persons who are ready to experiment with smaller type Y tanks will save money in the cost of the tank; they may also assist the writer if they will let him know of their work.

6. Tanks should be covered for safety and in order to keep out rain. The covers need not be air-tight. The bacteria need an air-tight cover, but it does not have to be built for them, as they cover themselves with a thick, leathery scum which keeps out all air. This scum often becomes more than one foot thick in the tank, and provision must be made for it.

7. Gas will form above the scum, and should be given a vent into the outlet pipe of the tank.

8. If the liquid entering the tank is acid, the bacteria will not thrive. Acid sewage must be neutralized by some means, as soda-ash or lime.

THE PURIFYING SYSTEM

The liquid flowing from the outlet of a good septic tank is almost clear, but it is impure chemically and may contain disease germs. If allowed to stand in the sun in pools, this liquid will ferment and produce a bad odor. If flies have access to it, they may carry disease germs to food. If it gets into drinking water, it may cause sickness or death.

An easy method of disposal of septic effluent is that of running it into a stream. This method is not allowable, however, except when the State Commissioner of Health at Albany gives his approval, and he will approve only when the following conditions exist: the stream must be sufficiently large; the water from the stream lower down must not be used by human beings for drinking purposes.

Discharging septic effluent into streams is thus recognized by law as being a dangerous practice. Since it is not possible for the Health Department to police the State so completely as to insure that this law is never violated, it must rest largely with the farmers of the State to see to it that neither they nor other persons near them thus endanger human lives.

Another method of disposing of septic effluent is by discharging it into a cesspool that is walled up with loose stones so that the liquid can find its way deep down into the soil. The objection to this practice is the same as that which holds against the use of the cesspool in place of the septic tank: liquid containing disease germs and rotted night soil should not be discharged into ground which carries water that later may form our own or a neighbor's water supply (page 1719).

For average country conditions the best method of disposing of septic effluent is to discharge it into purifying tile laid in the surface soil, in which there are great numbers of purifying bacteria known as aërobic bacteria because they thrive in the air. The rotted night soil in solution in the septic effluent will be changed by these bacteria into a chemical form suitable for plant-food; this form is also a permanent condition, so that effluent which has been thus acted on will not ferment if exposed to the sun. For the same reason the soil about properly installed purifying tile will not become sour and fill up with slime; the bacteria will keep it sweet, open, and fertile. Lime applied to the soil about the tile will foster the growth of the purifying bacteria.

Disease germs discharged from purifying tile into the surface soil will not die at once. As previously stated, typhoid germs will possibly live for three to six months in soil that is cultivated. In one case, however, in which the soil was under sod, these germs died in a much shorter time. A purifying bed under sod would thus seem to be a fairly rapid destroyer of disease germs. The sod would be a further advantage, as it would prevent dust and surface washing. Disease germs discharged from purifying tile into the surface soil will not be likely to find their way into underground veins of drinking water, for the reason that the soil along the length of the tile is never made more than damp, and there are thus no streams of effluent sinking into the ground as from a cesspool (page 1719).

Purifying tile must be laid near the surface so that the aërobic bacteria may receive plenty of air. The tile will not freeze in winter if hot waste water is discharged daily into the septic tank.

Rules for locating purifying tile

1. Choose a site such that the drainage from it, either on the surface or below ground, cannot reach any drinking-water supply before being purified by passage through 100 to 300 feet of soil, the distance depending on the character of the soil. Special care should be exercised in limestone regions (page 1720).

2. If it is necessary to locate the purifying tile at a distance from the septic tank, the two may be connected by a line of 3-inch vitrified sewer pipe with water-tight cemented joints, made as shown in Fig. 70.

3. The disposal area is best kept permanently in sod, although plowed land may be used under certain conditions if necessary.

4. The tile should not be located under a vegetable garden, a fruit orchard, or any other area from which crops are taken directly to the kitchen, regardless of whether these crops are to be cooked or to be eaten raw.

5. The underdrainage of the area must be such as would be considered satisfactory for field crops. Low, wet areas should not be used unless they are underdrained.

6. Areas of muck should not be used even though they are well drained. Aërobic bacteria will not thrive in muck.

7. Locate the area on the lightest, most open soil available. More tile is needed in heavy soils than in light soils.

8. Construct the septic tank in such a location that the full amount of purifying tile called for under rule 6 of " Rules for laying purifying tile " (page 1727) may ultimately be installed if experience shows its use to be necessary. At the outset, however, it will probably be best to install a smaller amount of tile, perhaps 100 feet in a single line, and to use this until experience has proved that for the actual conditions existing a greater length of tile is needed. In that case the original plan may be carried out without difficulty. If no more tile is needed, considerable expense and trouble will have been saved.

Rules for laying purifying tile

1. The trenches should be shallow, the best depth being 10 inches from the surface to the bottom of the trench. Trenches in land to be plowed should be 15 or 18 inches deep. If trenches are made deeper than 10 inches in heavy soil, the amount of tile used may have to be increased over the amounts given in rule 6.

2. The trenches should have an even slope, since uneven trench bottoms will cause undesirable sags in the line. The amount of fall required will depend on the design of the system and on the soil. For the plans shown in this lesson the trenches should have near the tank a fall twice as great as that allowed at the outer ends. In light soils the trenches should have a fall of $\frac{1}{8}$ inch in each foot near the tank and $\frac{1}{16}$ inch at the outer end in heavy soils, $\frac{1}{16}$ inch in each foot near the tank and $\frac{1}{32}$ inch at the outer end should be allowed. A fall of $\frac{1}{8}$ inch for each foot is approximately 12 inches in 100 feet; $\frac{1}{16}$ inch for each foot is 6 inches for each 100 feet; $\frac{1}{32}$ inch for each foot is 3 inches for each 100 feet.

3. Hard-burned agricultural drain tiles, which have an inside diameter of 3 inches and come in 12-inch lengths with plain square-cut ends, should be used. Tiles that are soft and porous in structure should not be used, as they will not last so well as those that are hard-burned.

4. The tiles should lie end to end in the trench, with a space at the joints of $\frac{1}{8}$ to $\frac{1}{4}$ inch, through which the liquid may pass into the soil. Liquid will not pass through the walls of either hard or soft tile. The joints should be covered with flat stones, broken pieces of larger tile, coarse gravel, cinders, stiff sod, straw, or any porous material that will keep the

earth from falling into the joints. Close the end of each run of tile with a flat stone. Cesspools need not be constructed at the ends of the runs, as all the sewage is to find its way into the soil through the tile joints and none should come out at the end.

5. The trench should be filled with the most open and porous material available. If the soil of the area is heavy, the use of a lighter soil for filling may possibly improve the bacterial action about the tile to such an extent that additional tile, which would be necessary if the filling were done with heavy soil, will not be required.

6. The length of tile required will depend on the amount of liquid and the character of the soil. It will depend also on the way in which the liquid is supplied to the tile. By arranging the tile in two sets and using one set one week and the other set the next week, the total amount of tile required in the two sets will be less than would be required if only one set were used. Or, expressing this in another way, when a given length of tile is found to be insufficient it may often be made to do the work by dividing it into two lengths which are used on alternate weeks or alternate fortnights. The Cornell sewage switch (Fig. 89) has been designed for use in cases of this kind.

No single run of tile should be longer than 100 feet, and runs of 50 feet are better under the conditions discussed in this lesson. The Cornell sewage divider (Fig. 90) has been designed to divide automatically and with accuracy a small stream of clear sewage for equal distribution into two runs of tile.

Lime applied to heavy soils at the rate of two or three tons on each acre will serve to loosen the soil and will tend to keep it from becoming sour.

The following rules will give an approximate idea of the amounts of tile probably required for the disposal of the daily effluent from septic tanks of the types considered in this lesson:

a. Disposal capacity each day for a foot of 3-inch tile in different soils:

		Gallons for each foot
Tile all in one run or one set of runs	Open gravel	4
	Light loam	3
	Medium loam	2
	Heavy loam	1

		Gallons for each foot in each set
Tile in two sets of one or more runs each (Fig. 88)	Clay	1½
	Heavy clay	1

b. Length of 3-inch tile required for disposal of sink water and laundry water of an average family using either a barrel septic tank, as in Plan A, or a tank with a direct closet, as in Plan B or Plan C:

		Feet of tile
Tile all in one run or one set of runs	Open gravel	10
	Light loam	15
	Medium loam	20
	Heavy loam	40
	Clay	75
	Heavy clay	100

c. Length of 3-inch tile required for each person, for disposal of effluent from a septic tank receiving sewage from a complete plumbing system such as that shown in Plan F:

		Feet of tile for each person
Tile all in one run or one set of runs	Open gravel	6
	Light loam	8
	Medium loam	12
	Heavy loam	25

		Feet of tile in each set for each person
Tile in two sets of one or more runs each (Fig. 88)	Clay	16
	Heavy clay	25

7. The distance between single runs of tile in light soils should be about 10 feet, while in heavy soils it need be only 5 feet.

Rules for laying drainpipe from the house to the septic tank

1. For sink water only, either iron pipe or vitrified clay sewer pipe may be used. Iron pipe is not suitable when the sink water contains much washing from milk cans; in this case nothing smaller than 4-inch vitrified sewer pipe should be used. Iron pipe may be of either $1\frac{1}{2}$- or 2-inch size, laid with a fall of not less than $\frac{1}{8}$ inch in each foot. Pipes laid with a very heavy fall are to be avoided if possible, for experience shows that they become readily stopped with grease. The pipe may be either black or galvanized; there are good arguments to be offered in favor of each kind. Black pipe is the cheaper but does not last so long as does galvanized pipe. All pipe fittings to be used at corners and junctions of pipe should be what are known as sanitary drainage fittings, and every piece of pipe should be reamed on the inside at the ends. All these

precautions are taken so as to insure that there shall be no projections inside the pipe on which solid matter may catch and stop the pipe.

2. Vitrified clay pipe of not less than 4 inches inside diameter is usually used for connecting from the house to the type Y septic tank. If water closets are not used and if there is little washing of milk cans, vitrified pipe for sink drainage only may be of 3 inches inside diameter. Cast-iron soil pipe is used inside the house for the riser pipe, or soil stack, in Plan F, and for the lower drain, which extends 5 to 10 feet or more from the foundation to where it joins the vitrified pipe.

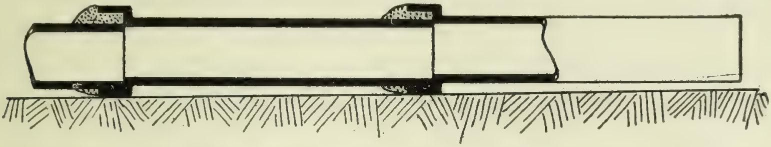

Fig. 69.— *Sewer pipe incorrectly laid*

Vitrified clay pipe comes in 2- or 3-foot lengths, the end of each length being enlarged so as to form a socket called a bell, or hub, as shown in Fig. 69. The end that is not enlarged is called the spigot end, and this kind of pipe is often spoken of as bell and spigot, or hub and spigot, pipe. The approximate inside diameter of the pipe in inches determines the size. Three-foot lengths are desirable, as there are then fewer joints.

The best fall for vitrified pipe is $\frac{1}{8}$ to $\frac{1}{2}$ inch in each foot. A lesser fall is not safe; on the other hand, if a fall of several inches is allowed in each foot, grease soon causes trouble. This difficulty may be avoided, however, by using soda or lye in the sink; therefore it is not advisable to go to great expense in order to secure small falls in the sewer ditch.

If possible the depth of the ditch should be below the reach of frost, but this depth is not essential if care is used to avoid sags in the pipe line where pools of water may stand and freeze. The hot water from the sink or the bathroom will normally prevent freezing.

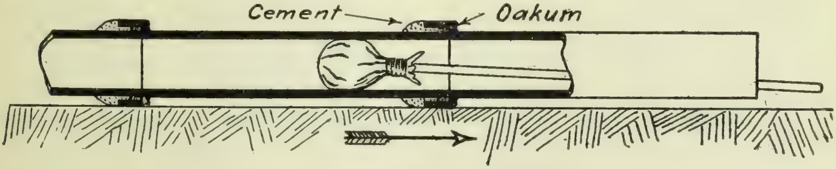

Fig. 70.— *Sewer pipe correctly laid*

Rules for laying vitrified sewer pipe

1. Place the pipe in the ditch with the lengths turned so that the direction of flow will be into the bell end, as indicated by the arrow in Fig. 70.

2. Provide a swab (Fig. 70) with a handle longer than one length of pipe. Place the large end of the swab in the end of the last length of pipe. Place the next length over the handle of the swab.

3. Set the bell of the new length over the spigot end of the last section, and push it well up until the spigot strikes the bottom of the bell. With a flat stick force a strand of oakum, or shredded tarred rope, in between the spigot and the bell until the spigot end is centered in the bell and the bottom of the pipe is smooth, as in Fig. 70. If oakum is not thus used the bottom of the drain will be uneven, as in Fig. 69, and cement mortar may work into the pipe.

4. With gloved fingers pack the joint with cement mortar, as shown in Fig. 70, being sure to get the mortar well into the bell and on the underside of the joint.

5. Rub the inside of the joint with the swab so as to insure a smooth pipe.

6. To cut a section off a length of vitrified pipe, use a sharp cold chisel and a hammer. Make a shallow cut in the glazing entirely around the pipe. Cut around again, going a little deeper. Continue cutting around lightly until the pipe snaps off at the mark.

Rules for mixing and laying concrete

These rules will not be given here because they would require too much space. Persons desiring this information should write for one or all of the following books, which may be obtained free of charge on application by postal or letter to the addresses given below:

Concrete tanks. Bulletin 23. Association of American Portland Cement Manufacturers, Land Title Building, Philadelphia, Pennsylvania.

Concrete in the country. Bulletin 26. Association of American Portland Cement Manufacturers, Land Title Building, Philadelphia, Pennsylvania.

Concrete construction for the home and on the farm. Atlas Portland Cement Company, 30 Broad Street, New York.

Small farm buildings of concrete. Universal Portland Cement Company, Information Bureau, 72 West Adams Street, Chicago, Illinois.

Oil-mixed Portland cement concrete. U. S. Agr. Dept., Office of Public Roads. Bulletin 46.

TYPES OF SEPTIC-TANK SYSTEMS

The designs of concrete tanks shown in this lesson have been prepared by the writer in order to furnish detailed and specific suggestions for solving in a practical and sanitary way sewage-disposal problems for practically all types of average country conditions.

Of these designs the type Y tanks have been generally installed in several States, with results so satisfactory as to prove conclusively their efficiency.

Disposal systems of the direct-closet type here shown are patterned after the sanitary privy described in Farmers' Bulletin 463, United States Department of Agriculture. As there reported, a closet similar to Fig. 92 was tested for nearly a year and was found to operate in a satisfactory manner. The designs here shown are elaborations of the original design and are intended to be substantial and permanent in construction, almost automatic in action, and in details especially suited for the conditions under which they are to be used.

Direct closets and underground purifying tile may be operated without connection with the kitchen sink, provided a pail of water is poured into the tank every day in order to dilute the liquid that it contains. In winter hot water should be used, in order to prevent the purifying tile from freezing.

All the designs here shown are undoubtedly capable of being improved. Persons effecting such improvements, or persons detecting bad features in the designs, will confer a favor by informing the Department of Rural Engineering, Ithaca, New York.

Plan A. Sink and barrel septic tank

Purpose.— This plan is offered as a cheap, permanent, and sanitary arrangement for caring for wash water from the sink only. It may be used even if milk cans are washed in the sink, but in this case the inlet pipe should be 4-inch vitrified sewer pipe.

Location.— In regular use no part of the system need be especially protected from frost, with the exception of the sink trap. If this is likely to freeze it should be boxed and packed in sawdust; in extreme

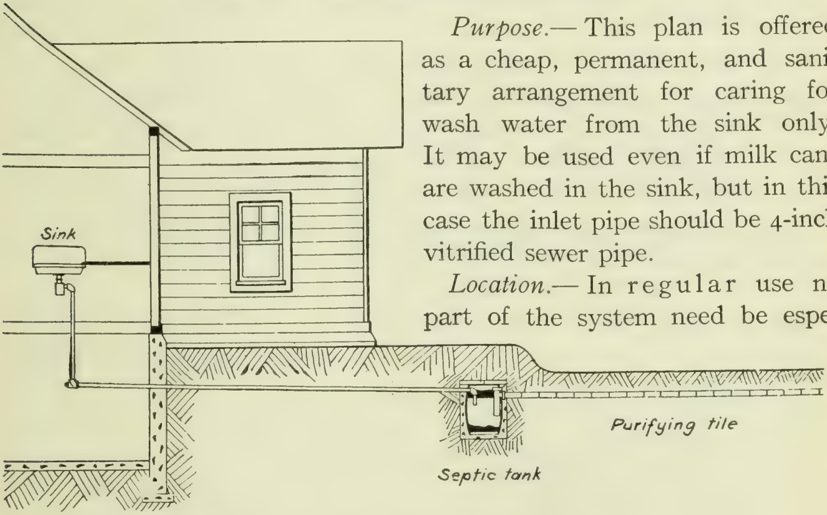

FIG. 71.— *Sink and barrel septic tank*

cases it might be placed in the cellar before boxing. When exposed to frost for any length of time without warm water passing through them, the trap and the tank had best be emptied for safety.

Special features.— The sink is placed with the bottom of the inside at such a distance from the floor that in washing dishes stooping will not be necessary.[2] All connections shown from sink and trap are threaded for iron pipe. In the cellar, at the turn of the drainpipe a detachable screw plug is fitted into the unused opening of the sanitary T fitting, so that it may serve as a cleanout when required.

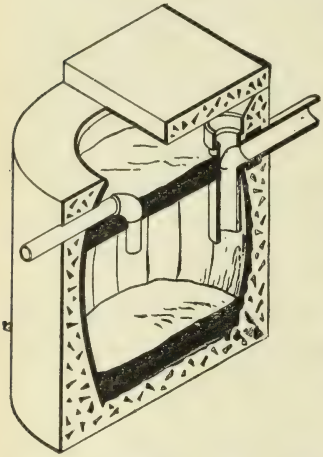

FIG. 72.— *Detail of barrel septic tank*

If 4-inch vitrified sewer pipe is used for milk washings, it should begin at the cleanout T in the cellar. Instead of vitrified pipe, it would be more in keeping with city practice to use cast-iron soil pipe and fittings in the cellar and out through the foundation wall, as in Plan F; this arrangement is not absolutely necessary for a sanitary system, however, and the vitrified pipe is easier to install.

Construction of tank.— Procure an old 40-gallon cider or tar barrel and a 3-inch vitrified sewer-pipe T fitting. Cut 8 inches from the long end of the T, as directed in "Rules for laying vitrified sewer pipe" (page 1729). Remove the top hoops of the barrel, and cut away the tops of some of the staves so that the 3-inch T may hang by its projecting branch in this opening, the top of the end bell being 1½ inch below the top of the barrel. It will be necessary to make the opening wider at the top than at the bottom, so that the bell at the top of the T may project sidewise outside of the barrel. If this is not done it will not be possible to hook the bell of the side branch over the staves at the bottom of the opening.

The level of the inside of the branch pipe of the T determines the level of the water in the tank. The inlet pipe should enter the barrel about

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[2] The following data are taken from "The New Housekeeping," by Mrs. Christine Frederick, published by Doubleday, Page & Co., New York City.

For every five inches difference in the woman's height there is a corresponding change of two inches and a half in the proper height of sink, table, or ironing board.

Height of woman		Proper height of working surface	Height of woman.		Proper height of working surface
Feet	Inches	Inches	Feet	Inches	Inches
4	10	27	5	5	30½
4	11	27½	5	6	31
5	0	28	5	7	31½
5	1	28½	5	8	32
5	2	29	5	9	32½
5	3	29½	5	10	33
5	4	30	5	11	33½

$\frac{1}{2}$ inch above water level. If iron pipe is used, the end should be turned down as shown. If vitrified pipe is used, it would enter the barrel through a T fitting similar to the one used at the outlet, making the notch $\frac{1}{2}$ inch shallower than the one made for the outlet.

For the barrel dig a round hole, making it 6 inches larger in diameter than the barrel and of such a depth that when the barrel is set on a layer of concrete in the bottom, at least 3 inches thick, the inlet and outlet openings will be at the desired levels.

Place the required depth of concrete in the bottom of the hole, tamp it down level, place the barrel on it, and connect the inlet and outlet pipes. Fill in the space around the barrel with concrete until it is level with the top. Level off the concrete, and leave the barrel in the concrete permanently. When the concrete has set, fill the barrel with water and cover it with a flat stone or a 3-inch slab of reinforced concrete.

The purifying system.— Lay a sufficient amount of purifying tile according to rules given on page 1726.

Plan B. Sink, direct closet, and barrel septic tank

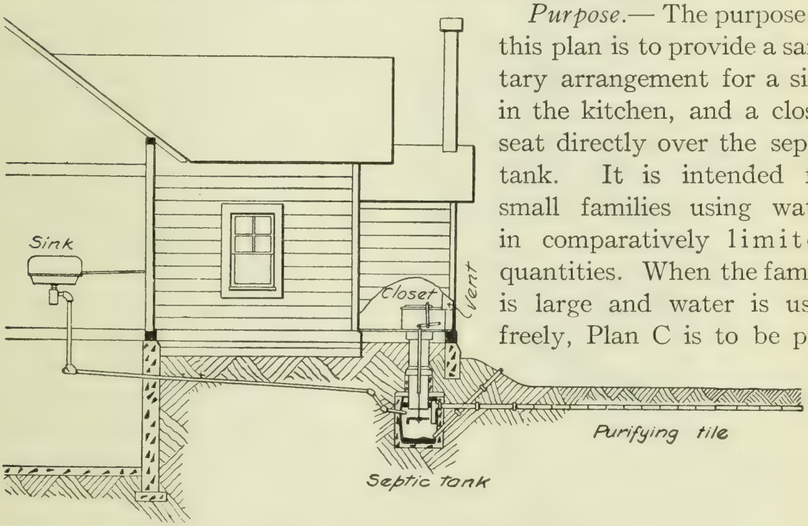

FIG. 73.— *Sink, direct closet, and barrel septic tank*

Purpose.— The purpose of this plan is to provide a sanitary arrangement for a sink in the kitchen, and a closet seat directly over the septic tank. It is intended for small families using water in comparatively limited quantities. When the family is large and water is used freely, Plan C is to be preferred. If many milk cans are washed, 4-inch vitrified sewer pipe should be used in place of the small iron pipe here shown, as explained for Plan A.

Location.— The closet should connect directly with the house or the woodshed. The purifying tile should be located according to rules on page 1725, and the same precautions against frost should be taken as those recommended under Plan A.

Special features.— The sink is located and the piping is arranged as for Plan A, except that the sink drain enters the tank in such a way that the sink water will keep the baffle board clean.

The vertical inlet pipe is shown as 15-inch vitrified sewer pipe, but it may be of galvanized iron. It should extend down 1 inch below water level.

The baffle is connected with the seat cover by means of levers and rods on each side of the seat, in such a manner that when the cover is raised the baffle almost touches the end of the inlet pipe and when the cover is down the baffle is lowered into the water. The vertical baffle board is intended to prevent agitation from the sink water when the seat cover is up.

The inside of the closet seat may be constructed of concrete, as in that for Plan C. It may be a galvanized iron hopper, or it may be a glazed-tile hopper sold by manufacturers of sewer pipe. Whatever its construction, it should be painted inside with white enamel paint and kept clean by washing. The closet should be screened from flies, and kerosene oil might be kept on the water at the bottom of the vertical inlet pipe. The vent pipe should connect below the closet seat, as explained for Plan C.

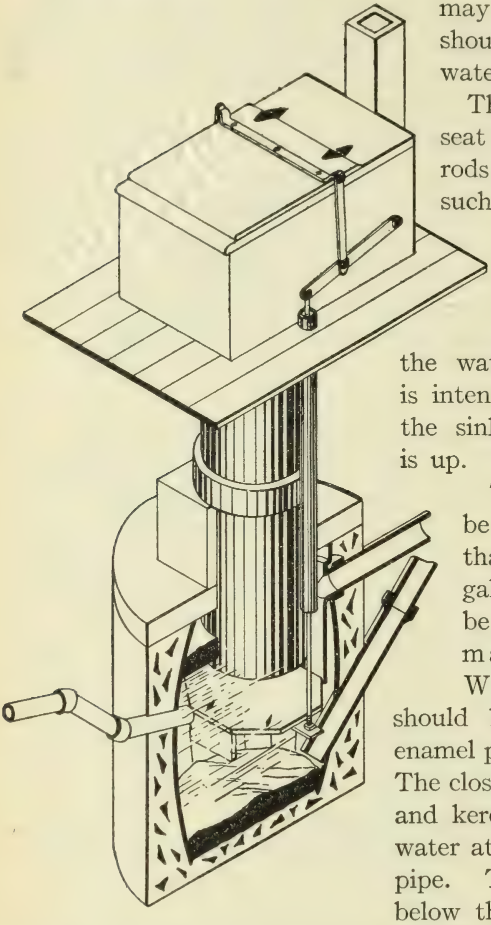

FIG. 74.— *Detail of barrel septic tank and direct closet*

Construction of the tank.— Instructions given under Plan A apply to this tank, except that the vertical inlet pipe is extra and must be supported by concrete on the tank cover. A 3- or 4-inch vitrified drainpipe must also be built in, so that once in four or five years a pump pipe may be put down to the bottom of the tank from the outside for the purpose of removing the sludge. This sludge cleanout is important, since the vertical inlet pipe practically fills the top opening of the tank.

The purifying system.— This should be located according to rules given on page 1725 and constructed according to rules given on page 1726.

Plan C. Sink, direct closet, and concrete septic tank

Purpose.— The tank here shown, being larger than that in Plan B, makes this system desirable when a generous supply of running water is freely used at the sink. If many milk cans are washed, the drainpipe must be 4-inch vitrified sewer pipe instead of the iron pipe shown, as explained under Plan A.

Location.— Precautions regarding frost are the same as those recommended under Plan A. The outlet end of the tank must be accessible for cleaning. The closet should connect with the house, for comfort and convenience. The purifying tile need not begin near the tank, but, if necessary, may be connected with it by 3-inch vitrified sewer pipe with cemented joints.

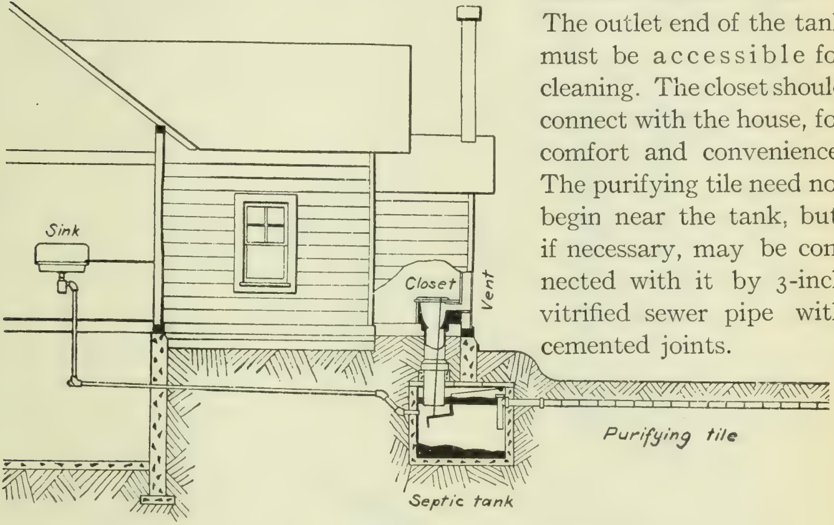

FIG. 75.— *Sink, direct closet, and concrete septic tank*

Special features.— The sink is located and the piping is arranged as for Plan B. Since the tank is longer than that in Plan B, access for cleaning should be provided at the outlet end. The connection between the baffle board and the seat cover as shown here, although simpler than that shown in Plan B, is not so desirable for the reason that the long vertical connecting rods must here work in slots in the tank cover and in the floor. This may permit the escape of gas into the closet.

A plan for the construction of a homemade sanitary closet bowl is clearly shown in Fig. 76. The upper length of 15-inch sewer pipe is cut to such a length that the top of the bell comes just level with the floor. Inside this bell is placed a ring of galvanized sheet iron, the inside diameter of the ring being 12 inches and the outside fitting the bell of the sewer pipe. A wooden form is now built to suit the cover to be used, and is so placed that a plumb line hung in the center of the vertical pipe will be 1½ inch forward of the rear end of the opening in the closet seat. The inside of the closet bowl is plastered with concrete mortar, mixed rather dry and not worked too long when once in place. The final surface is rendered as smooth as possible with a homemade rounded trowel of heavy tin. If the builder is able to provide a short length of form to hold the concrete while it is setting, the inside of the bowl should curve in to a sharp edge at the front, as shown in Fig. 76. The vent pipe should open from the inside of the closet bowl; it should be connected with the kitchen chimney if possible, but if necessary it may be separate as shown.

The vertical baffle boards are for the purpose of preventing excessive agitation from the incoming sink water, regardless of whether the closet cover be up or down. The rods should be so placed and adjusted that when the cover is down the horizontal baffle board will be below the level of the sink-drain inlet, and when the cover is up the lower vertical baffle should extend down to below the inlet drain.

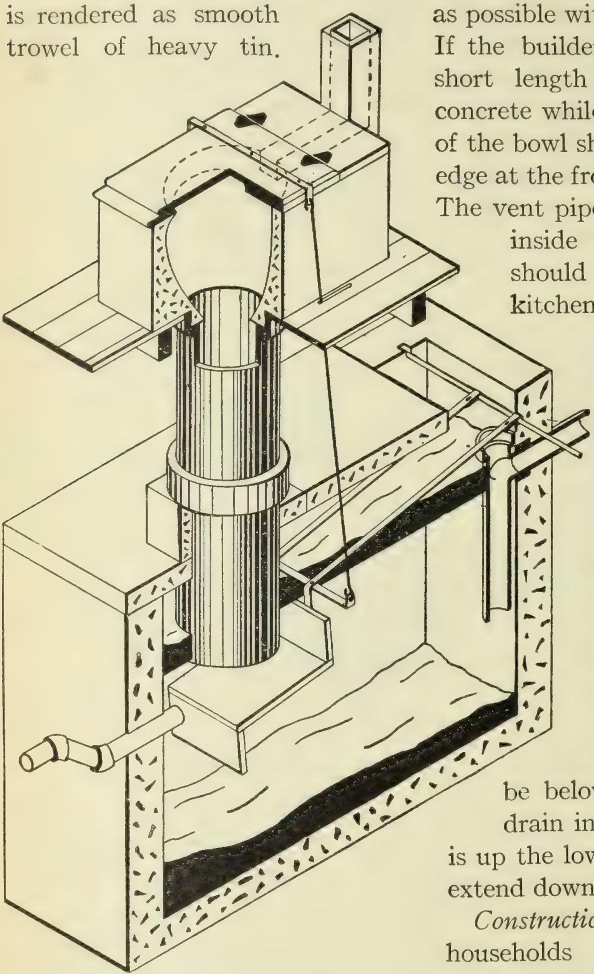

FIG. 76.— *Detail of direct closet and concrete septic tank*

Construction of the tank.— For households of fifteen members or less, the tank shown in Fig. 76 should be 5 feet long, 2½ feet wide, and 4 feet deep inside; the outlet pipe should be so placed that a space of 1 foot is left above water level. The walls are to be 6 inches thick; 4 inches is a sufficient thickness for the bottom. Concrete is mixed according to instructions in the handbooks referred to on page 1730. The top of the outlet T is left open as a gas vent.

Notches should be left in the walls at the outlet end so as to receive the pipe, which serves as a pivot for the ends of the baffle-board irons.

The purifying system.— This should be located according to rules given on page 1725 and laid according to rules on page 1726.

Plan D. Pail closet

Purpose.— This arrangement of a seat over a receptacle containing either dry earth or a chemical solution is suitable for use in cases in which it is impossible to install a septic tank and purifying tile. An arrangement in which earth, ashes, or shavings are used in the pail is suitable when there is ample opportunity for burying the contents of the pail without endangering health. The use of chemicals in the pail[3] is to be preferred wherever it is especially desirable to avoid all possible danger of disease.

Location.— The main argument in favor of this type of closet is that it can be located anywhere to suit convenience. By properly venting the pail box into any chimney that is always in use, there need be no trouble from unpleasant odors even when the closet is located in one of the rooms of the house.

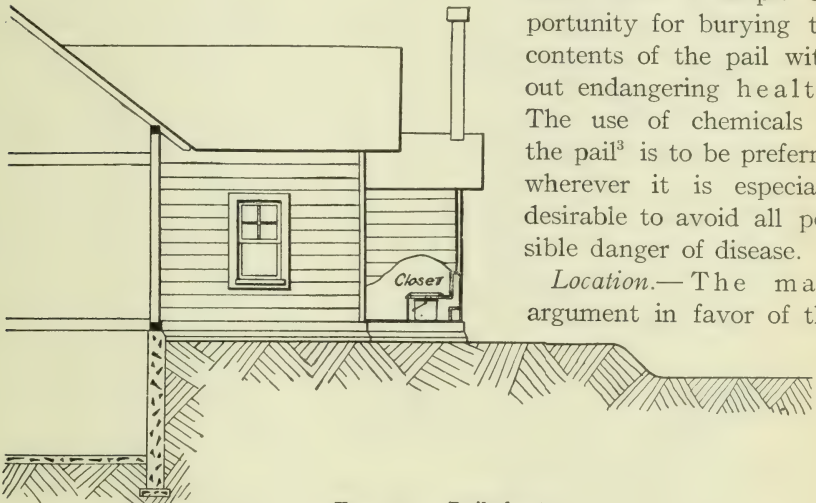

FIG. 77.— *Pail closet*

Special features.— In the choice of materials to use in the pail it is well to remember that when any dry material is used, such as dust or shavings, the sanitary condition of the closet will depend on the faithfulness with which the dry material is dusted into the pail whenever it is used. When children use this closet, its contents may be neglected and flies are likely to gather. If suitable disinfecting chemicals are used in the pail in sufficient quantities to keep the contents covered, a more sanitary arrangement will be obtained. The night soil will not be rendered perfectly harmless, however, unless the chemical used is of such a nature as to break up the solid matter in the pail so that all may be disinfected (page 153).

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[3] Chemical-closet systems of this kind are for sale by the companies listed below. Other firms selling similar closets will confer a favor by sending advertising literature to the Department of Rural Engineering, Ithaca, New York.
The Waterman Waterbury Company, Minneapolis, Minnesota; West Disinfecting Company, 2 East 42d Street, New York; National Manufacturing Company, Ogdensburg, New York.

Construction of the pail closet.— A suggestion for the construction of a homemade pail closet is shown in Fig. 78. The most important feature to be noted is the provision for ventilation, consisting of air-intake openings at the bottom of the closet and a vent pipe leading from the top of the closet on the side away from the air intakes. If desired the seat itself may be bought ready-made for less than two dollars. The pail may be an ordinary galvanized garbage pail, about 14 inches in diameter and 14 inches high. Two pails and one cover should be provided so that one pail may be removed and covered while an empty pail is left in the closet.

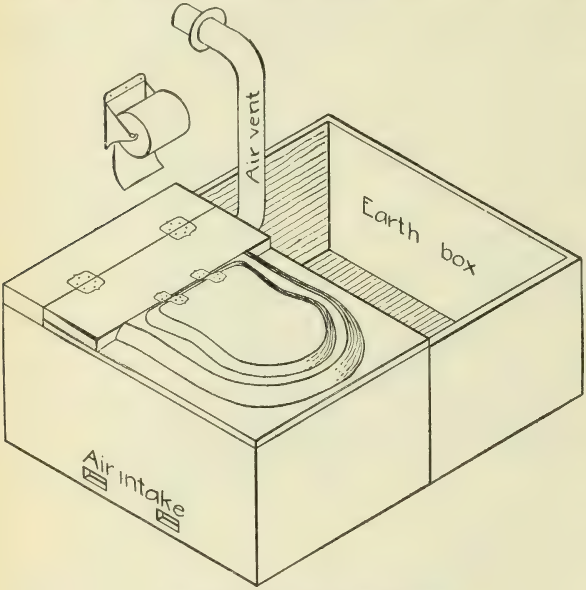

FIG. 78.— *Detail of pail closet*

Disposal system.— Even more care should be used in disposing of the contents of an earth-closet pail than in locating the purifying tile for a septic tank. All material should be buried in a safe place, and should be covered at once in order to guard against flies.

Plan E. Direct closet and chemical tank

Purpose.—This type of tank has been put on the market in order to supply a system that possesses the sanitary features of the chemical-pail-closet system described under Plan D, but requires attention at less frequent intervals. The latter requirement is obtained by the use of a receiving tank of a capacity considerably greater than that of the pail described under Plan D.

Location.— In choosing the location for the system, the important points to be considered are convenience of access from the house and convenience of access for cleaning.

Special features.— A discussion of the advantages and disadvantages of this type of system is given on page 1721. In addition it should be noted that this system, like all other direct-closet systems having tubes connecting the seat with the tank, is likely to be somewhat unsanitary because of the soiling of the inside of the tube by use. In fairness to the prospective buyer, emphasis should also be laid on the fact that manufacturers' estimates as to the length of time that the tanks may be used before becoming full, may possibly be based on incorrect data. Frequent emptying of these tanks is more or less of a nuisance and also something of an expense, as a new supply of chemicals must be bought each time that the tank is emptied. In estimating the effective capacity of a chemical tank the volume of the chemical charge must be deducted from the total tank capacity. The total volume of waste given off each day by the average adult is $\frac{1}{3}$ to $\frac{1}{2}$ gallon, or .040 to .067 cubic foot, one cubic foot being equal to $7\frac{1}{2}$ gallons. It should be remembered that in emptying the tank care must be taken to pump out as much of the liquid as possible, since considerable capacity may be lost through the neglect of this detail.

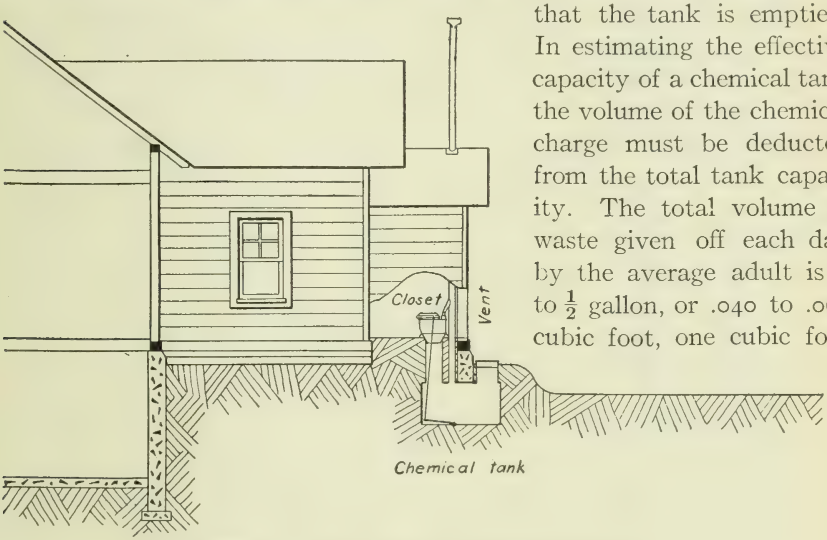

Fig. 79.— *Direct closet and chemical tank*

Construction of the tank.— The tanks of the foregoing type offered for sale are of metal and are constructed according to the ideas of the manufacturers.[4] Some system of automatic agitator is desirable, but if not provided the contents of the tank may be stirred with a stick from time to time, as the contents should be entirely sterile.

Disposal system.—If the regular charge of chemical is always placed in the tank at each filling, all germ life should be destroyed, so that the contents should be safe for use as a fertilizer. Reasonable caution, however, would indicate that the material had best be well buried as a matter of safety.

---

[4] Chemical-tank closet systems are for sale by the following companies:
Hawkeye system, similar to Fig. 79, Sanitary Chemical Closet Company, Incorporated, Bradford, Pa., and Sears, Roebuck & Company, Chicago, Illinois.
Cottage system, West Disinfecting Company, 2 East 42d Street, New York.

Plan F. Complete plumbing system and type Y septic tank

Purpose.— As shown in Fig. 81, the type Y septic tank is designed to receive the sewage from a home as completely equipped with modern plumbing conveniences as a city home. A country home with such a plumbing system must of course be fitted with pipes supplied with water under pressure, either from a natural gravity system, an artificial gravity system, or a compressed-air pressure system; the last named may be one storing water directly in the air tank or one delivering water as needed direct from the well, the spring, or the cistern. Such a house must be provided with a furnace in order to keep the pipes from freezing.

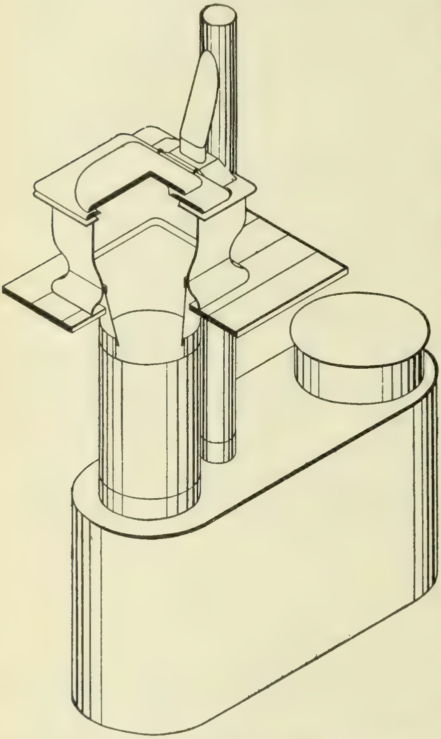

FIG. 80.— *Detail of direct-closet and chemical tank*

Location.— There is more opportunity for freedom of choice in the location of a septic tank receiving the sewage from a house equipped with a water closet than in locating one for use with a direct closet. The tank had best be about 50 feet from the house, although it may be nearer or it may be much farther away. The tank must be located so that there will be at least a slight fall toward it from the house, and in addition the location must be such that an ample amount of purifying tile may be installed, as discussed under the rules for locating and for laying purifying tile as given on pages 1725 and 1726 respectively. The tank had best be covered with about a foot of soil, and this may be planted to grass or with shrubbery as desired.

For drainage of the sludge the best location for the tank is on sloping ground, so that a sludge drain laid almost level will come to the surface, within a reasonable distance. If such a situation is impossible, a sludge-

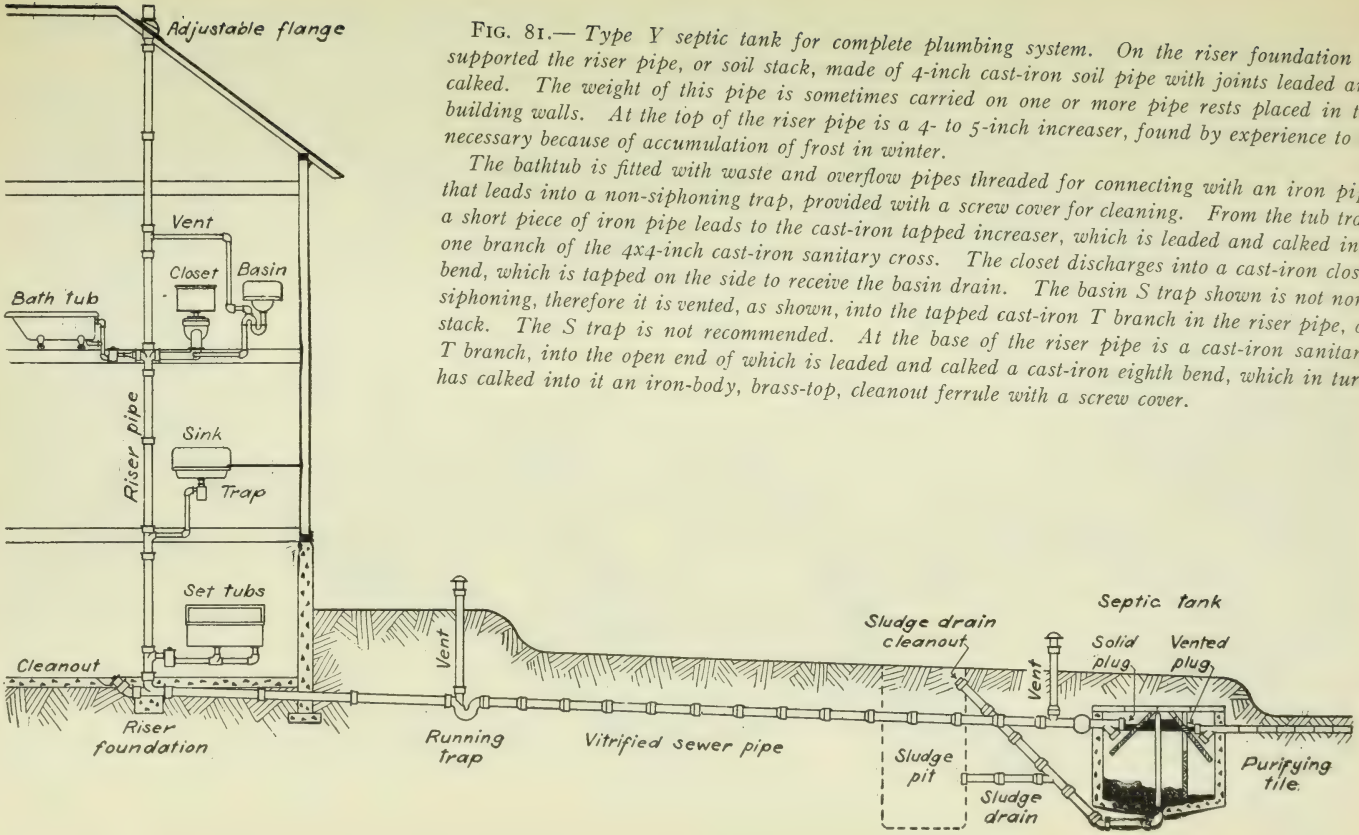

FIG. 81.— *Type Y septic tank for complete plumbing system. On the riser foundation is supported the riser pipe, or soil stack, made of 4-inch cast-iron soil pipe with joints leaded and calked. The weight of this pipe is sometimes carried on one or more pipe rests placed in the building walls. At the top of the riser pipe is a 4- to 5-inch increaser, found by experience to be necessary because of accumulation of frost in winter.*

The bathtub is fitted with waste and overflow pipes threaded for connecting with an iron pipe that leads into a non-siphoning trap, provided with a screw cover for cleaning. From the tub trap a short piece of iron pipe leads to the cast-iron tapped increaser, which is leaded and calked into one branch of the 4x4-inch cast-iron sanitary cross. The closet discharges into a cast-iron closet bend, which is tapped on the side to receive the basin drain. The basin S trap shown is not non-siphoning, therefore it is vented, as shown, into the tapped cast-iron T branch in the riser pipe, or stack. The S trap is not recommended. At the base of the riser pipe is a cast-iron sanitary T branch, into the open end of which is leaded and calked a cast-iron eighth bend, which in turn has calked into it an iron-body, brass-top, cleanout ferrule with a screw cover.

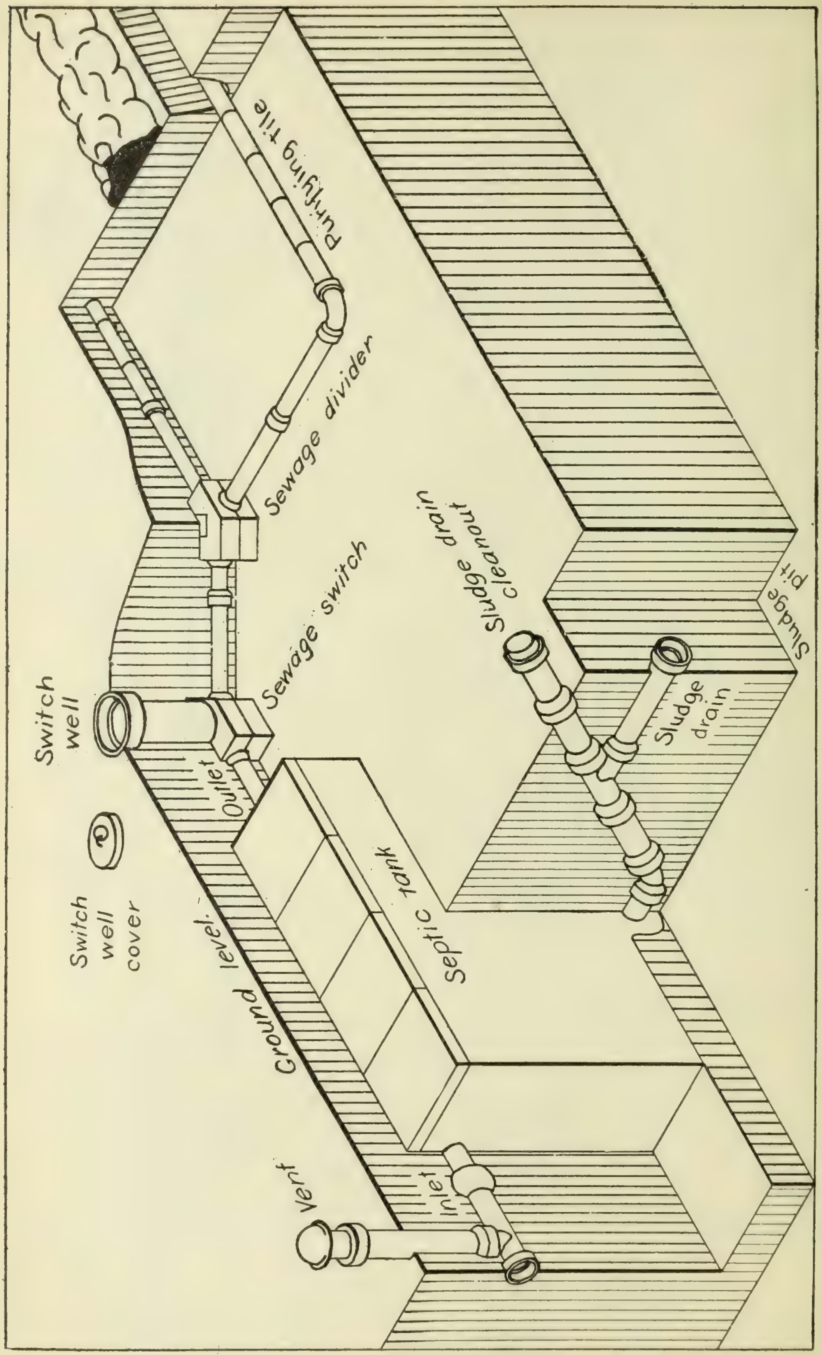

FIG. 82.— *Type Y septic tank and complete underground disposal system*

drain system such as that shown in Fig. 81 or in Fig. 82 may be installed. This plan is open to some objections, however, and in level sections the best plan may be to omit the sludge-drain pipe entirely and depend on emptying the tank with a pump.

Special features.— In Fig. 82 is clearly seen one special feature of a complete disposal system in which the Cornell sewage switch and the Cornell sewage divider are used (page 1747). By means of these fittings a large quantity of sewage may be evenly distributed in many comparatively short runs of tile suitable for use in heavy soil, without at the same time having the purifying tile at a level lower than that of the water in the septic tank. This is a most important feature for level regions.

The vent in the inlet pipe is a desirable feature if the tank is at some distance from the house. If the tank is near the house the vent had best be omitted.

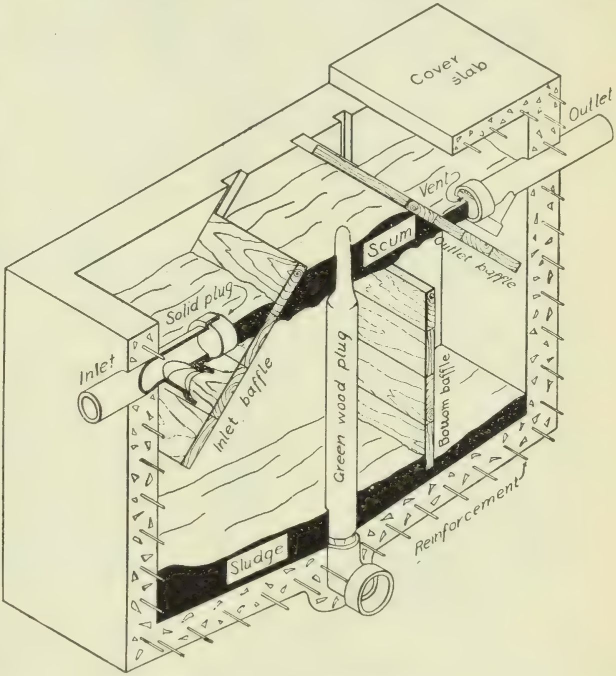

Fig. 83.— *Type Y septic tank*

Construction of the tank.— In the type Y septic tank the inlet is through a 4-inch, vitrified, single, Y-branch fitting, while the outlet is a 3-inch, single, Y-branch. The level of the outlet is so arranged that the branch pipe of the inlet is covered with water, but water does not stand in the inlet pipe itself.

The end of the inlet pipe is closed with a solid plug in order to prevent the escape of foul gases, but if there is need the plug may be removed for cleaning the pipe. The vented plug in the outlet pipe permits the escape of gases into the soil.

The baffles are made of $1\frac{3}{4}$-inch plank slipped into slots made in the walls of the tank. The inlet baffle prevents agitation from incoming sewage and virtually extends the inlet pipe downward to the center of the tank; the outlet baffle prevents large solids from leaving the tank; and the bottom baffle serves to provide at the outlet end of the tank a quiet chamber in which very fine solid particles may settle and thus be prevented from stopping up the soil about the purifying tile.

The side walls of the tank are 7½ inches thick, the ends 6 inches, and the bottom 4 to 6 inches, all being reinforced according to directions in the concrete handbooks. The depth of the tank is standard for all sizes discussed in this lesson, and dimensions are given in Figs. 84 and 85. The inside length and width of the tanks depend on the number of persons for whose use it is intended, as shown in the following table:

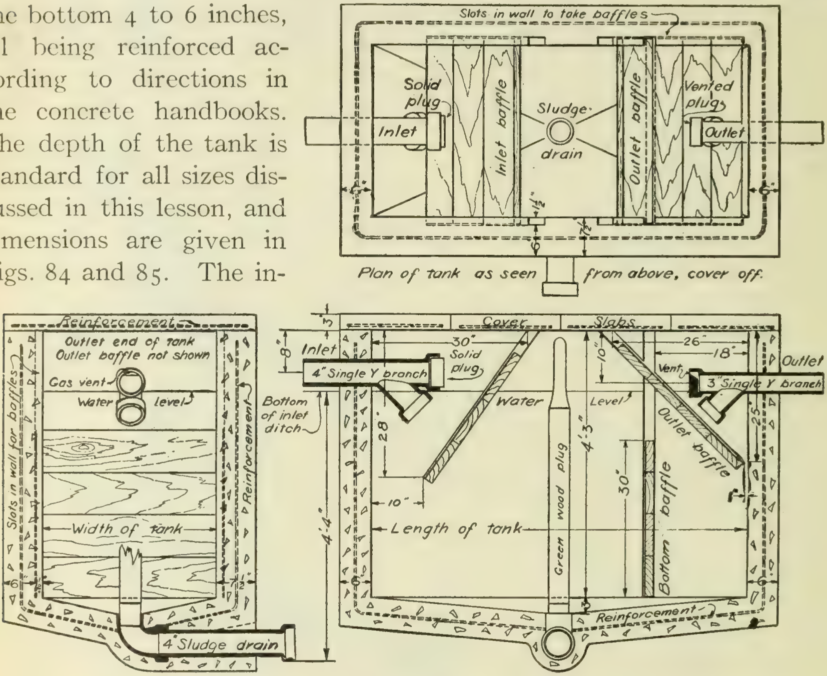

FIG. 84.— *Details of type Y septic tank*

TABLE I.— INSIDE DIMENSIONS OF TYPE Y SEPTIC TANKS

Number of persons	Dimensions of tank	
	Inside width (Feet)	Inside length (Feet)
6 or less	2½	5
8	3	6
10	3	7
12	3	8
14	3½	8
16	3½	9
18	4	9
20	4	10

The sizes of tank in the foregoing table are ample, and the action of the bacteria will be impaired rather than improved if for given numbers of persons the tanks are made larger than is here specified.

The problem of forming the slots in the walls of the type Y septic tank is not a serious one. It is necessary only to nail to the concrete side of the inside form, beveled cleats of the shape shown in Fig. 86, and to locate them on the form according to the dimensions given in Figs. 84 and 85. Care should be taken to have the two cleats for the inlet-baffle slots both at the inlet end of the form, and the crossed cleats for the other two baffles at the outlet end of the form.

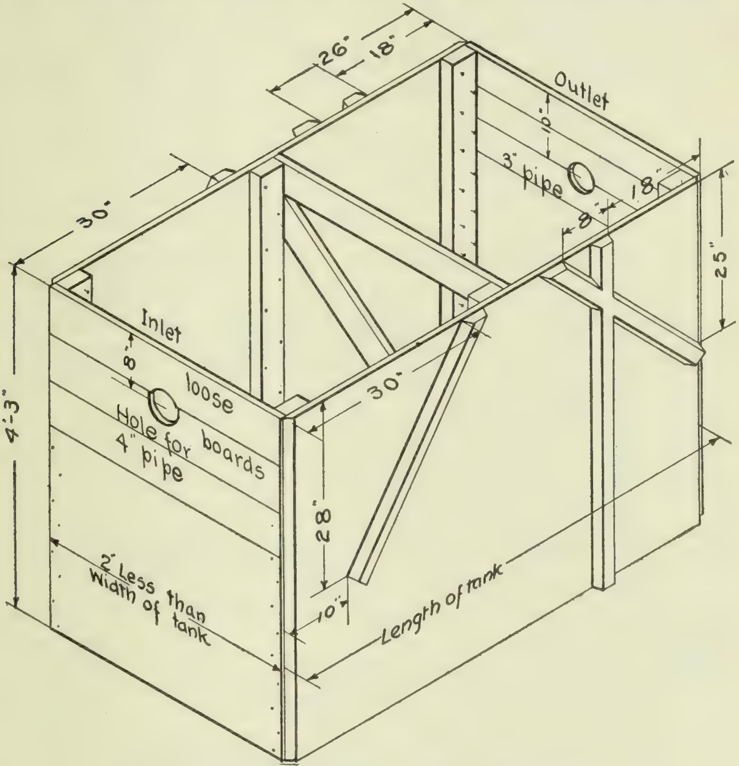

FIG. 85.—*Inside form for type Y septic tank*

Care must be used in building the corners of the inside form so that it can be easily removed from the finished tank. The construction shown in Fig. 87 is recommended. The ends of the boards forming the sides of the form should be well beveled off, and the boards forming the ends should be set out about $\frac{1}{8}$-inch beyond the ends of the side boards as shown. Nail securely to the 2x4-inch corner pieces all the end boards except those cut to receive the inlet and outlet Y's. These pieces should be left loose.

When assembling the form as a whole, nail these 2x4-inch corner pieces to the sides of the form, leaving the nails projecting so that they may be drawn with a hammer after the concrete has set. Before placing the inside form in the pit, paint the outside of it, including the cleats, with a mixture of raw linseed oil and kerosene in equal parts. This will prevent the concrete from adhering to the cleats.

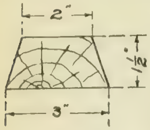

FIG. 86.— *End of beveled cleat for forming slots for baffle boards*

In order to remove the forms after the concrete has set, draw the nails that hold the 2x4-inch corner pieces to the sides, and remove the cross braces and the ends of the form. After this the sides, with their cleats, may be removed, leaving the slots for the baffle boards.

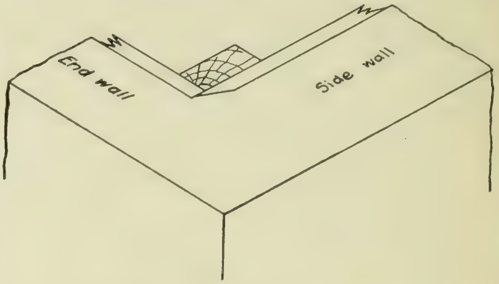

FIG. 87.— *Detail of corner of form*

Before putting the tank into regular use, the baffle boards should be inserted according to the detail shown in Figs. 83 and 84, and the tank should be completely filled with water. The tank should be covered with slabs of reinforced concrete or with paving stones. Wooden planks should not be used, as they may rot before the tank needs cleaning and permit the earth covering to fall.

The purifying system.— The principles governing the design, layout, and construction of a complete underground purifying system have been fully treated at the beginning of this lesson on pages 1725 and 1726.

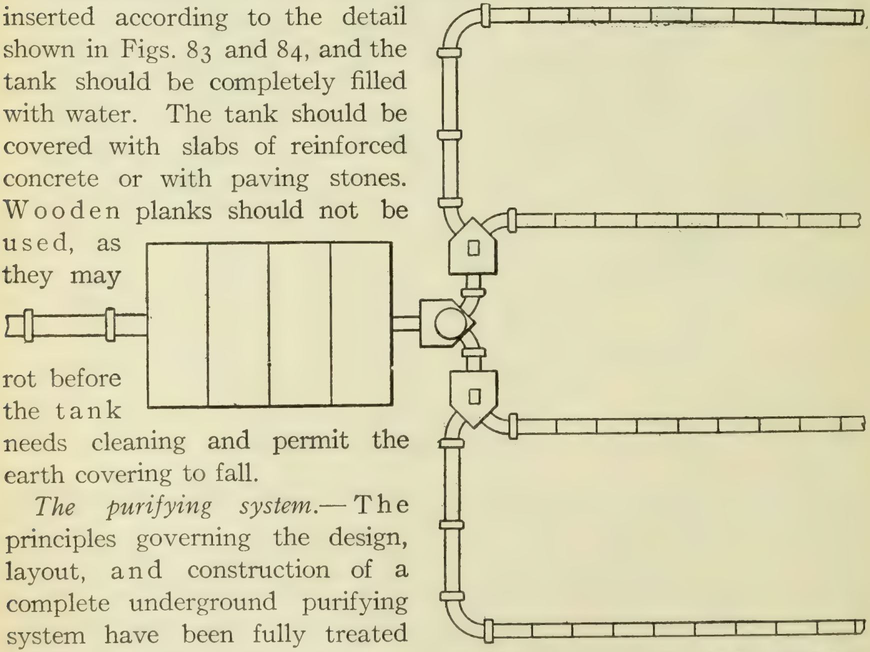

FIG. 88.—*Plan of underground disposal system*

A plan of a simple arrangement of tile in two sets, each set consisting of two separated runs, is shown in Fig. 88. The sewage is here turned from one set of tile into the other by means of the Cornell sewage switch, shown in Figs. 88 and 89. The switch base block is 14 inches wide and about 4 inches thick, and is made with a Y channel in its surface, the grooves at their intersection being made with practically vertical sides and flat bottoms. Plugs with wire handles are cast in the branch grooves as forms. The switch is operated by inserting one plug in its branch and removing the other.

Drawings and instructions for making the forms for the Cornell sewage switch and the Cornell sewage divider may be obtained by application to the Department of Rural Engineering, Ithaca, New York; but, as stated on page 1726, readers of this lesson are advised not to go to the trouble of making these fittings until they find by experience that they are necessary.

The Cornell sewage divider is made by slightly altering the forms used in making the switch. The base block of the divider differs from that of the switch in that the grooves here shown have sloping sides and are rounded at the bottom in such a way that the sharp edge at their intersection serves to divide very small streams of sewage with great accuracy.

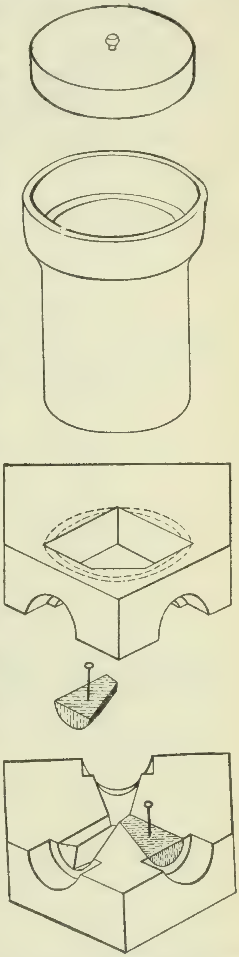

FIG. 89.—*Cornell sewage switch*

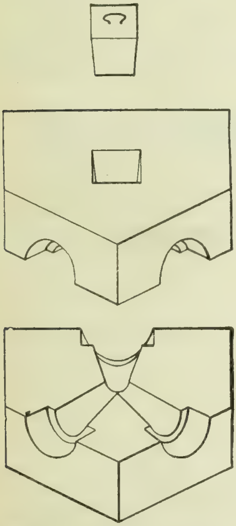

FIG. 90.—*Cornell sewage divider*

Plan G. Complete plumbing system and metal septic tank

Purpose.— At least one company[5] is manufacturing and selling a ready-made metal septic tank, which may be used in place of the type Y septic tank if desired. So far as the writer knows, the tank operates in an entirely satisfactory manner. Some of its special features might make it particularly useful in solving certain difficult sewage-disposal problems. The list price is about twice the usual cost of a type Y tank and three times the amount for which a number of these concrete tanks have actually been made.

---

[5] Andrews Heating Company, Minneapolis, Minnesota.

Location.— The tank must be located so that the inlet pipe is nearly 3 feet above the purifying tile, but, owing to the construction of the tank, it may be located in almost any situation, even in the cellar of the house if need be, in order to obtain this required elevation.

Special features.— The tank illustrated in Fig. 91 comes all ready to install. It is made gas-tight so that it may be placed in almost any location. The discharge is effected by means of an intermittent siphon, an arrangement that insures good distribution of the effluent in the underground tile and renders unnecessary the use of the Cornell sewage switch or the sewage divider.

Construction of the tank.— The tank is advertised as being of metal of ample thickness, carefully riveted and finished in a workmanlike manner, with air-tight, covered, cleanout holes.

The purifying system.— As indicated in Fig. 91 the purifying system consists of a central line of 4-inch tile in which there are many Y branches. From these branches lateral pipes of 3-inch, hard-burned, drain tile are led off. The entire system is well filled with sewage at each discharge of the siphon, and during the resting period before another discharge the soil bacteria have ample opportunity to perform their work of purification.

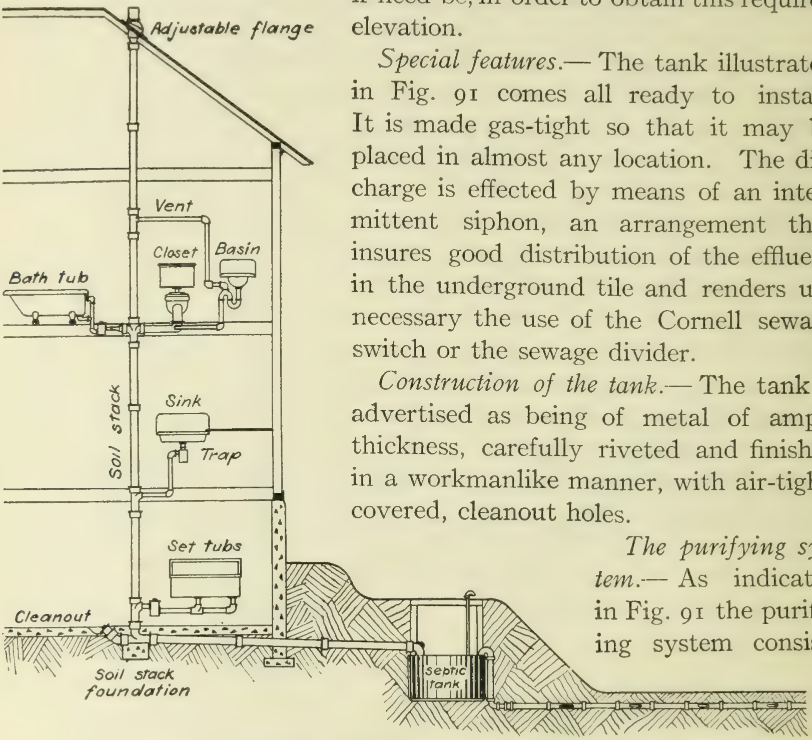

FIG. 91.— *Complete plumbing system and metal septic tank*

PLANS INSERTED FOR REFERENCE

In order that the readers of this lesson may compare the plans here presented with those representing the ideas of other writers on this subject, it has seemed best to include in this lesson illustrations, descriptions, and brief discussions of two other types of sanitary privies. With these discussions are given some of the reasons why certain features of these reference plans were not duplicated in the plans recommended in this lesson.

The L. R. S. privy

History.— The original design[6] shown in Fig. 92 was prepared by Dr. L. L. Lumsden, Dr. N. Roberts, and Professor C. W. Stiles, of the United States Public Health and Marine-Hospital Service, to meet the need for more sanitary methods for the disposal of night soil in the country. In August, 1911, the United States Department of Agriculture published Farmers' Bulletin 463, entitled "The Sanitary Privy," in which the question of rural sanitation is discussed and the L. R. S. privy is described and recommended. This design and the design of the "Hawkeye" chemical closet (Fig. 80) served as the basis for the designs of the closets shown in Figs. 74 and 76 of this lesson.

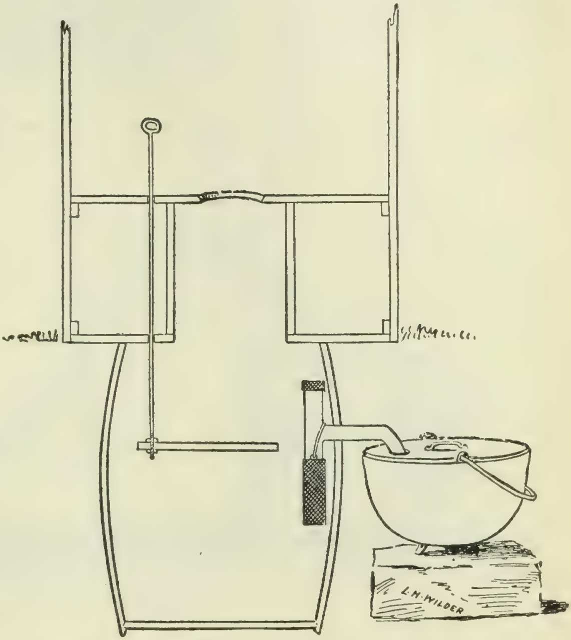

FIG. 92.— *Diagram of improved L. R. S. privy*

Special features.— Important features of the L R. S. privy are (1) the use of the "wet system," or septic-tank system with a direct closet not flushed with water; (2) the use of a baffle board in order to prevent splashing and the consequent introduction of air into the liquid in the tank, which would interfere with the development of the rotting bacteria; (3) the use of a submerged outlet pipe; and (4) the provision of a metal pot as a receiver for the effluent, so that it can be boiled in order to destroy the dangerous bacteria and animal parasites or their eggs which it may contain.

In the direct closets shown in plans B and C in this lesson the baffle board is arranged to be raised and lowered automatically by the seat cover instead of by hand; and the inlet passage is carried down below the water level in order to prevent, as much as possible, the escape of unpleasant odors from the tank through the inlet opening.

---

[6] First published under the title of "Preliminary note on a simple and inexpensive apparatus for use in safe disposal of night soil." U. S. Public Health Reports, 1910, Nov. 11, Vol. 25 (No. 45), pp. 1619-1623, Fig. 1.

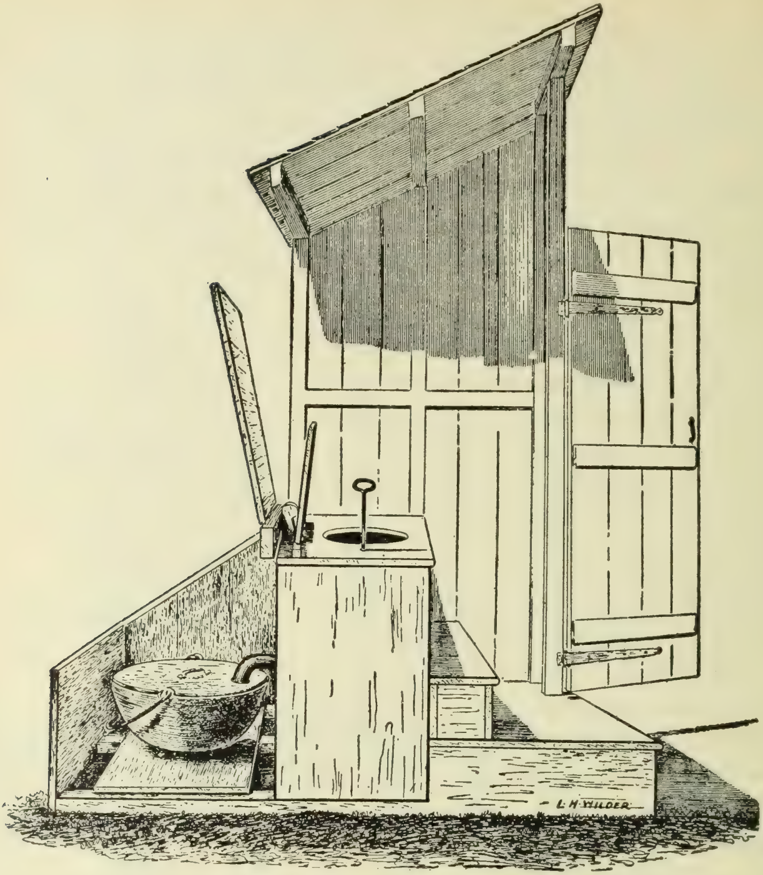

FIG. 93.— *View of L. R. S. privy*

Purifying system.— In reference to the disposal of the effluent from an L. R. S. privy, the designers wrote in 1910 as follows:

> Disposal of effluent.—(1) Heat: If a suitable (metallic) vessel is provided to receive the effluent, a fire may be built under the vessel and the effluent heated to boiling. Or if a wooden or concrete effluent tank is used, the effluent may be transferred to some other vessel for boiling.
>
> After boiling, the fluid may be safely used for fertilizer under any conditions.
>
> Heat disinfection is the only measure which can to-day be recommended unreservedly.
>
> (2) Burial: Burial will unquestionably decrease the dangers of spreading infection, but in the present state of our knowledge this method of disposal can not be relied upon as safe. If burial of the effluent is practiced, the fluid should be disposed of not less than 300 feet from and down hill from any neighboring water supply and not less than 2 feet underground, and then only provided the soil itself is a good filter. Burial in a limestone region may contaminate water supplies miles away.
>
> (3) Chemical disinfection: Chemical disinfectants, such as chlorinated lime and certain coal-tar derivatives, have the great advantage of cheapness and can be relied upon to destroy pathogenic bacteria. Our knowledge regarding the action of chemical disinfectants upon the eggs and spores of the various animal parasites is at present very

rudimentary, but so far as results are known, their practicable use does not seem to be so efficient in the destruction of the zooparasitic as of the bacterial infectious organisms. Therefore, pending further investigations, the use of chemically treated excrement as fertilizer should not be regarded as unqualifiedly safe.

(4) Chemical disinfection with subsequent burial: Inasmuch as chemical disinfection can be relied upon to destroy pathogenic bacteria, and inasmuch as burial greatly reduces the danger from animal parasites, a suitable combination of the two methods (chemical disinfection and burial) can be used with reasonable safety.

(5) Sewers: In partially sewered towns, the effluent from these privies may be emptied into the sewers. If conditions are such that the addition of this material to the sewage is dangerous, then the entire sewerage system needs correction.

In this lesson the boiling of the effluent from a septic tank is not recommended, because boiling is advisable mainly for the purpose of destroying the eggs of certain animal parasites and in the North these parasites are not dangerous as they are in the South.

In the quotation given above the recommendation that purifying tile, if used, should be laid not less than 2 feet below the surface cannot be successfully followed in any but the very lightest and most open soils. The reason for this is that the useful purifying bacteria on which we depend to keep the soil about the tile sweet and open must be near the surface in order to get air. In this lesson it is recommended that the tile be laid near the surface in some spot from which there is little danger of disease being spread. Of the "Rules for locating purifying tile," on page 1725, rule 4 is considered by many well-informed sanitary engineers as being too conservative. In the opinion of these men there is so little danger in locating tiles under gardens or orchards, and there is so much benefit to the crops likely to result from such a practice, that it should rather be recommended than condemned. The writer's feeling is, however, that purifying tiles should not be laid under gardens unless there is absolutely no other location possible, and then they should be laid only at the maximum depth allowable for good operation.

The Kentucky sanitary privy

History.— The State Board of Health of Kentucky has been experimenting for several years with a design of three-compartment tank shown in figures 94 and 95. At least two pails of water are to be poured into the tank each day unless drains from the house are led into the tank, in which case other water need not be supplied. With house drains connected, however, some trouble is experienced from odors from the first chamber, so that a vent pipe becomes necessary.

The closet bowl and inlet pipe shown in Fig. 76 form an arrangement which the writer believes to be better than an open-tank arrangement (Fig. 94), because, as previously stated, with a submerged inlet pipe the gases are trapped and prevented from rising. There is of course danger that the inlet tube in Fig. 76 may become fouled; but the design of the closet bowl there shown, overhanging, as it does, the sides of the tube, will largely prevent this. The closet bowl itself will be fouled occasionally;

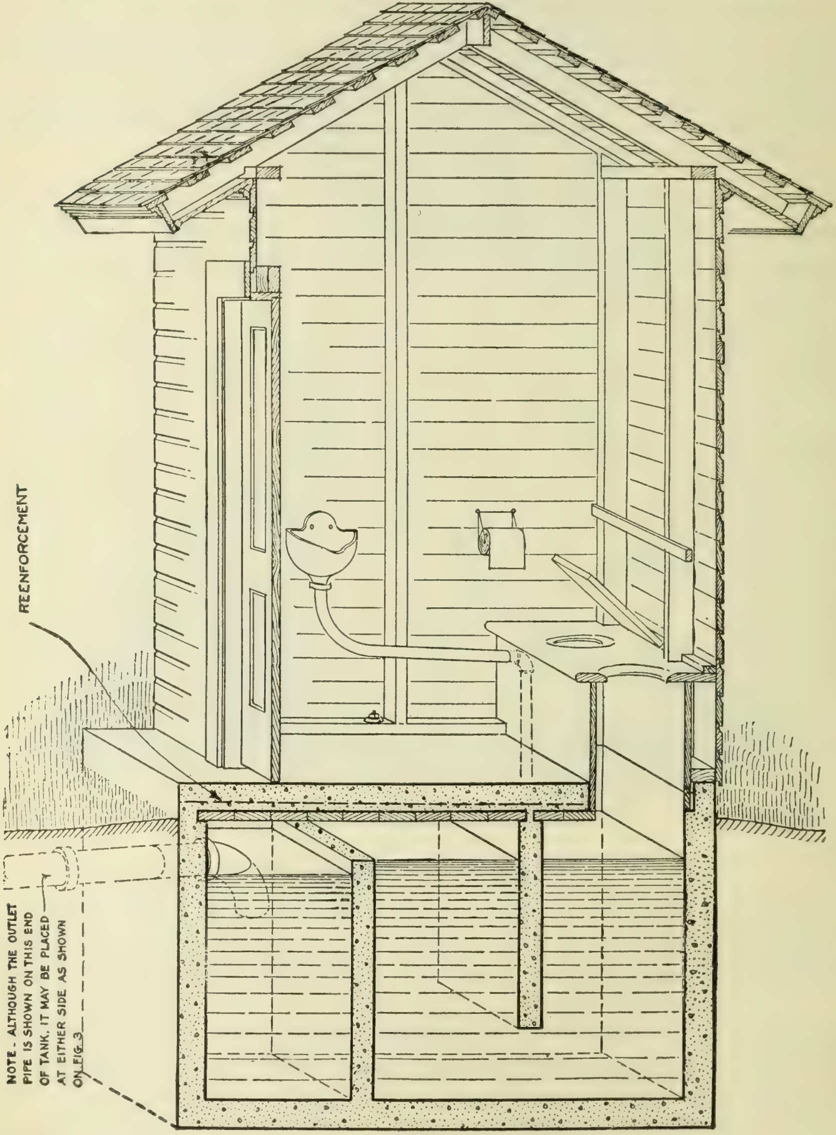
REENFORCEMENT
NOTE. ALTHOUGH THE OUTLET PIPE IS SHOWN ON THIS END OF TANK, IT MAY BE PLACED AT EITHER SIDE AS SHOWN ON FIG. 3
FIG. 1
VERTICAL SECTION OF TANK AND HOUSE
KENTUCKY SANITARY PRIVY

FIG. 94.— *Sanitary privy in use in Kentucky*

but, since this is to be well painted and is easily accessible, it can be cleaned without difficulty. In this connection, the location of the closet seat in reference to the center of the inlet tube, as specified on page 1736, is an important item.

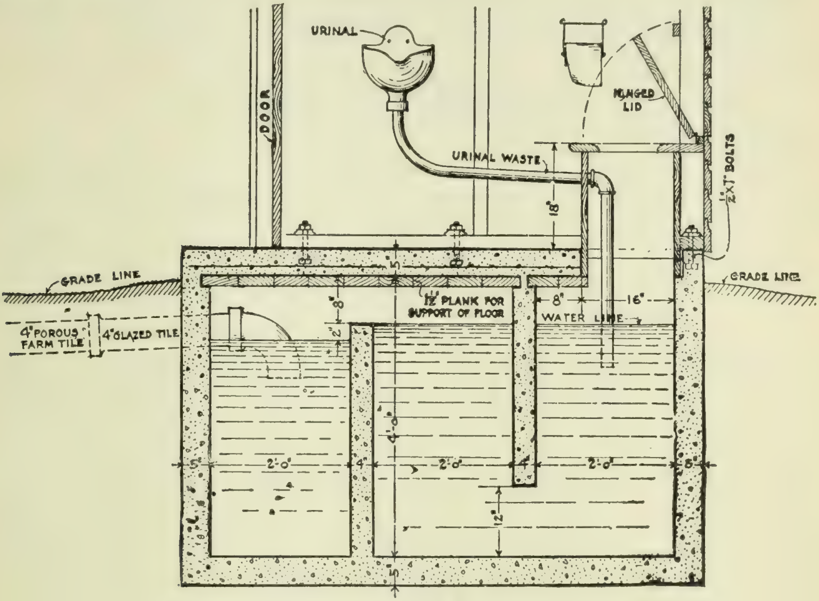

FIG. 2
~VERTICAL SECTION~

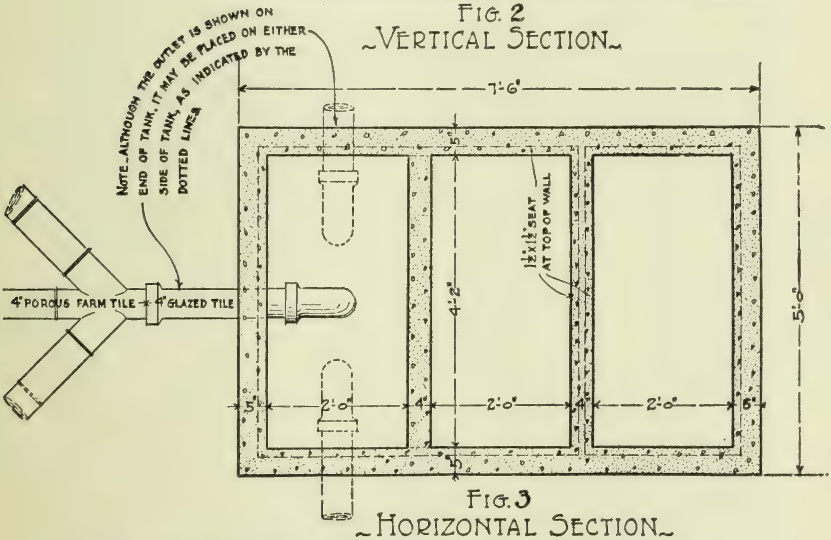
NOTE_ALTHOUGH THE OUTLET IS SHOWN ON END OF TANK, IT MAY BE PLACED ON EITHER SIDE OF TANK, AS INDICATED BY THE DOTTED LINES
7'-6"
5"
1½"X1½" SEAT AT TOP OF WALL
4'-2"
5'-0"
4" POROUS FARM TILE
4" GLAZED TILE
5"
2'-0"
4"
2'-0"
4"
2'-0"
5"
5"

FIG. 3
~HORIZONTAL SECTION~

KENTUCKY SANITARY PRIVY

FIG. 95.— *Details of Kentucky sanitary privy*

Septic tanks of several distinct compartments have been very generally advocated in the past; but the experience of the writer has been that tanks of one compartment, if provided with suitable baffles, are efficient. They have the added advantage of being simple to construct, and in designs for homemade tanks simplicity is a very important feature.

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SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

W. A. STOCKING, JR., *Acting Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 59 MARCH 1, 1914 SANITATION SERIES No. 4

SEWAGE DISPOSAL FOR COUNTRY HOMES

DISCUSSION PAPER

This discussion paper may be returned with answers to the questions and with any suggestions of your own. While the answering of these questions is not absolutely necessary, much greater benefit will be derived if you share with others your own experience. It will also help us to understand your point of view. The lesson may be used in the grange and in the club where these subjects are considered.

Return the discussion paper to the Supervisor of the Reading-Course for the Farm Home, New York State College of Agriculture, Ithaca, New York.

1. Have the suggestions given in this lesson been of direct help to you in improving sanitary conditions about your home? Outline what you have done.

2. Has this lesson been of no service in enabling you to solve your home problems of domestic sewage disposal? Outline the problem that troubles you, explaining the situation fully.

3. Do you know of any sewage-disposal system in your neighborhood that is simpler and yet as sanitary as those outlined in this lesson? Describe the system, discuss it, and tell what you know of its practical operation.

4. Give your own ideas as to why a steep drainpipe becomes stopped with grease more readily than does a drain laid more nearly level?

5. What is the difference between the sewage bacteria that develop in a septic tank and those that thrive in the soil about the purifying tile?

6. What is the objection to the use of a cesspool instead of the purifying tile here recommended?

Name..

Address..

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VOL. III. No. 61 APRIL 1, 1914 RURAL LIFE SERIES No. 7

ATTIC DUST AND TREASURES

Blanche Evans Hazard

The questions in the discussion paper of November, 1913, concerning certain table furnishings and historical relics in general have met with a cordial response. The photographs and letters describing heirlooms that have been received have given us courage to appeal to farmers' wives throughout the State of New York to go beyond their dining-rooms and china closets to their attics in search of more treasures.

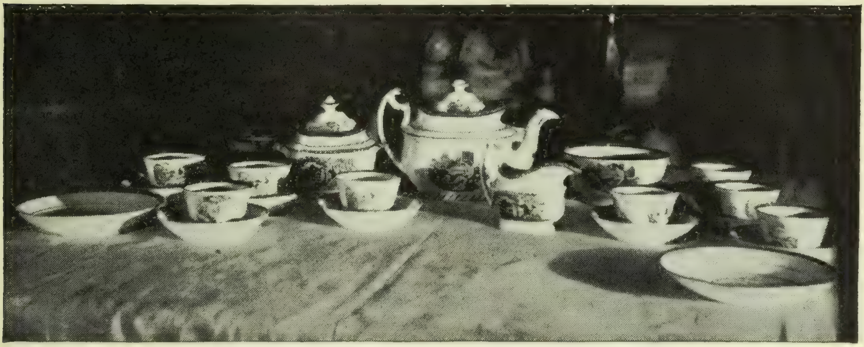
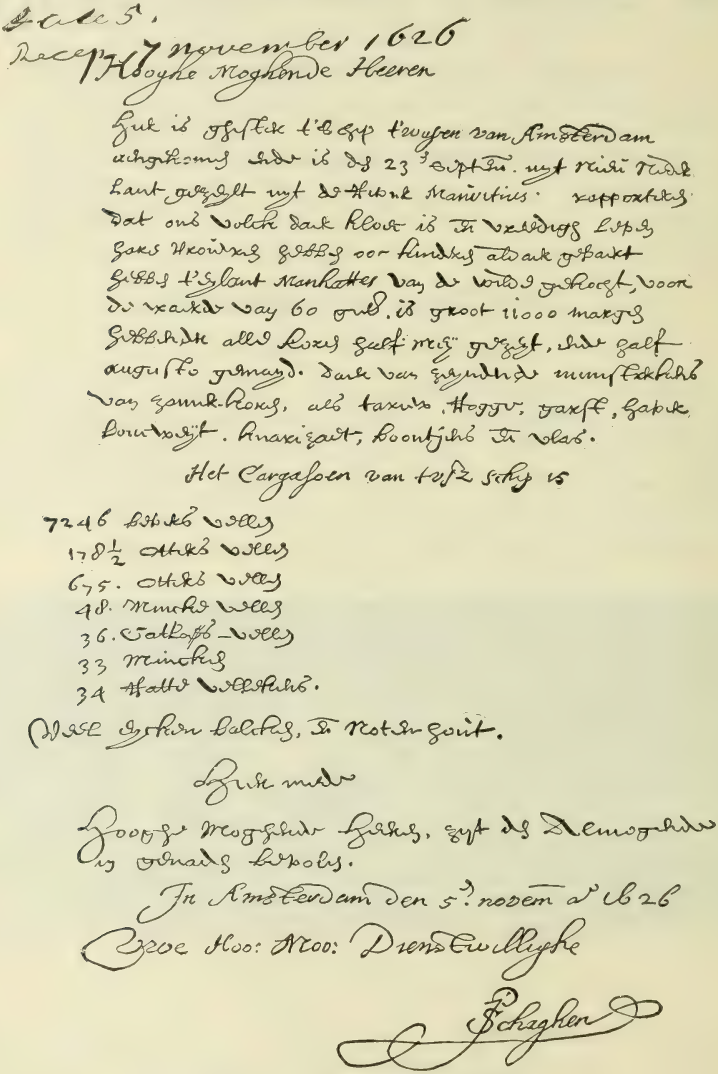


Fig. 96.— *A wedding gift to a New York bride in 1761*

The appeal is made just now in order to save valuable historical material from its threatened fate during the spring house-cleaning. Knowing that you would not destroy those treasures in the attic if you realized that they were of value or of service to any person or community, I have thought of telling you just what sort of things might give unbounded delight to people of another century and meanwhile furnish necessary material to historians of the present day. With such material they may be able to reconstruct the story of the past in your neighborhood and county, and present it as history for future generations to read and enjoy.



[illegible] 5.

Recep. 7 november 1626

Hooghe Moghende Heeren

Hier is gisteren 't schip 't Wapen van Amsterdam aengecomen ende is den 23 septemb. uyt Nieu Nederlant gezeylt uyt de Riviere Mauritius. rapporteren dat ons volck daer kloeck is en vredich leven. haere vrouwen hebben oock kinderen aldaer gebaert, hebben 't eylant Manhattes van de wilde gekocht, voor de waerde van 60 guld. is groot 11000 morgen. hebben haer alle koren half mey gezeyt, ende half augusto gemaeyt. daer van zijnde monsterkens van zomer-koren, als tarwe, rogge, garst, haver, boeckweyt, kanarisaet, boontjens en vlas.

Het Cargasoen van 't voorsz schip is

7246 bever vellen
178½ otter vellen
675. otter vellen
48. mincke vellen
36. catlossen vellen
33 mincken
34 ratte vellekens.

Veel eycken balcken, en noten hout.

Hiermede

Hooghe Moghende Heeren, zyt de Almogende in genade bevolen.

In Amsterdam den 5en novem ao 1626

Uwe Hoo: Moo: Dienstwillighe

P. Schaghen

FIG. 97.— *Peter Schagen's letter*

These writers of history feel that a search of private houses in cities is already hopeless, for families living in apartments have no attics. All the "old things" that did not seem beautiful or valuable enough to display in their living-rooms or to keep in vaults at the bank have been put into the rubbish barrels — furniture, clothes, and records all faring alike. By happy chance here and there, in one case out of a hundred, some member of the family has gathered such treasures and given them over to an historical society in the city or the State in which he lives. This is a wise and generous thing to do. I am looking forward to the day when every county seat in the State of New York will have one or more rooms set apart in its courthouse for the meeting-place of its county historical society, and for the purpose of displaying the historical records and relics which its members will be glad to leave there, fully labeled, not only for safe keeping, but also for the pleasure of neighbors and of children of surrounding communities.

Some records, you can easily understand, belong to a whole county or State rather than to a single person. For example, a letter such as Peter Schagen's is too valuable and of too general interest to keep in one family's store chest, because it gives such a good picture of early New York life when the Dutch were settling New Amsterdam. I want you to have an opportunity to read the letter here and to see just how it looked when Peter Schagen wrote it nearly three hundred years ago.

" High and Mighty Lords:

" Yesterday arrived here the ship, the *Arms of Amsterdam*, which sailed from New Netherland . . . on the 23d of September. They report that our people are in good heart and live in peace there. . . . . They have purchased the Island of Manhattes from the Indians, for the value of sixty guilders. . . . They had all their grain sowed by the middle of May, and reaped by the middle of August. They sent thence samples of summer grain, such as wheat, rye, barley, oats, buckwheat, canary seed, beans and flax.

" The cargo of the aforesaid ship is:

7246 beaver skins
178½ otter skins
675 otter skins
48 minck skins
36 wild cat skins
33 mincks
34 rat skins
Considerable oak timber and hickory

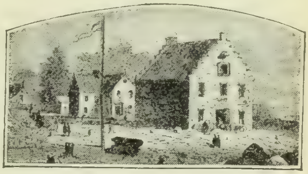


FIG. 98.— *The first warehouse on Manhattan*

" Herewith, High and Mighty Lords, be commended to the mercy of the Almighty.

" Your High Mightinesses' obedient,

" P. Schagen.

" In Amsterdam, Nov. 5, A. D. 1626."[1]

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[1] Quoted from " Indians and pioneers." Blanche Evans Hazard and Samuel T. Dutton. Boston. 1897.

Later, after Peter Stuyvesant came to be Governor, some one of the little colony in New Amsterdam wrote a letter home saying, " Mynheer Stuyvesant introduces here a thorough reform." A letter from Stuyvesant himself showed the need of his action. He said, " The people here are without discipline and approaching the savage state. A fourth part of the city of New Amsterdam consists of rumshops and houses where nothing can be had but beer and tobacco." We can be surprised that even then there were social and ethical problems in Manhattan Borough, and we can also feel ourselves coming nearer to Peter Stuyvesant through sympathy for him in his perplexities. Suppose these letters and these pictures had been lost instead of having been properly saved and given over to the archives of the old Amsterdam city!

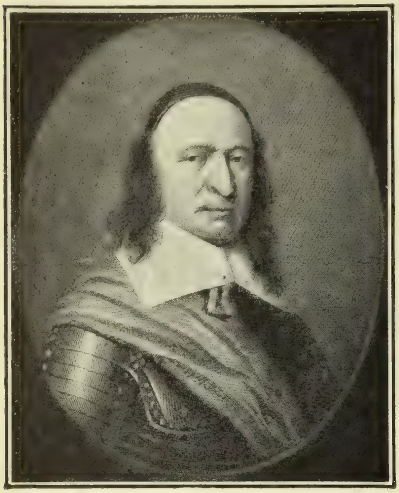

FIG. 99.— *Peter Stuyvesant*

Another illustration from revolutionary times will serve to show how pleasure may be given to future generations by the saving of correspondence. We now are able to reconstruct the history of the aid given by France in general, and by Beaumarchais in particular, to our revolutionary forefathers through the letters and diaries kept by interested French families. Beaumarchais helped us under the guise of a socalled firm, Roderigue Hortalez & Co. This is a part of a brief but typical letter sent to our Continental Congress:

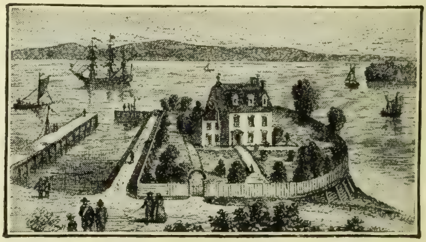

FIG. 100.— *Governor Stuyvesant's home, The Whitehall, 1658*

" Gentlemen, consider my house as the head of all operations useful to your cause in Europe, and myself as the most zealous partisan of your nation, the *soul of your successes*, and a man profoundly filled with the respectful esteem with which I have the honor to be,

Roderigue Hortalez & Co." [2]

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[2] Quoted from " Beaumarchais and the American Revolution." Blanche Evans Hazard. Published by the general Society of the Daughters of the American Revolution. Boston. 1910.

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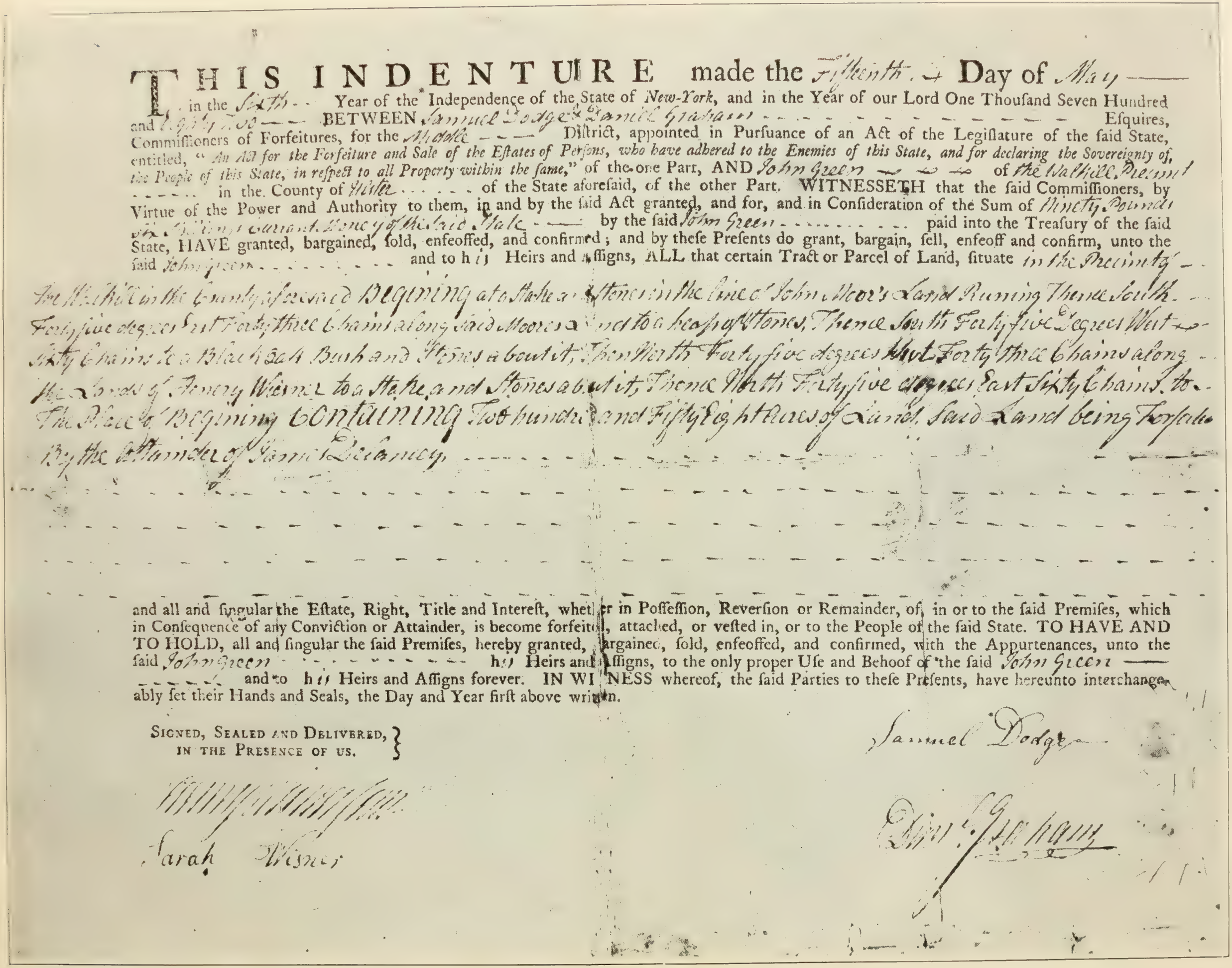

THIS INDENTURE made the Fifteenth Day of May in the Sixth Year of the Independence of the State of *New-York*, and in the Year of our Lord One Thouſand Seven Hundred and Eighty two BETWEEN Samuel Dodge & Daniel Graham Eſquires, Commiſſioners of Forfeitures, for the Middle Diſtrict, appointed in Purſuance of an Act of the Legiſlature of the ſaid State, entitled, "*An Act for the Forfeiture and Sale of the Eſtates of Perſons, who have adhered to the Enemies of this State, and for declaring the Sovereignty of the People of this State, in reſpect to all Property within the ſame,*" of the one Part, AND John Green of the Wallkill Precinct in the County of Ulster of the State aforeſaid, of the other Part. WITNESSETH that the ſaid Commiſſioners, by Virtue of the Power and Authority to them, in and by the ſaid Act granted, and for, and in Conſideration of the Sum of Ninety Pounds six Shillings current Money of the said State by the ſaid John Green paid into the Treaſury of the ſaid State, HAVE granted, bargained, ſold, enfeoffed, and confirmed; and by theſe Preſents do grant, bargain, ſell, enfeoff and confirm, unto the ſaid John Green and to his Heirs and Aſſigns, ALL that certain Tract or Parcel of Land, ſituate in the Precinct of the Wallkill in the County aforesaid Begining at a Stake and Stones in the line of John Moor's Land Runing Thence South Forty five degrees East Forty three Chains along said Moores Land to a heap of Stones, Thence South Forty five Degrees West Sixty Chains to a Black Oak Bush and Stones about it, Then North Forty five degrees West Forty three Chains along the Lands of Henry Wisner to a Stake and Stones about it, Thence North Forty five degrees East Sixty Chains to The Place of Begining Containing Two hundred and Fifty Eight Acres of Land, Said Land being Forfeited By the Attainder of James Delancey,

and all and ſingular the Eſtate, Right, Title and Intereſt, whether in Poſſeſſion, Reverſion or Remainder, of, in or to the ſaid Premiſes, which in Conſequence of any Conviction or Attainder, is become forfeited, attached, or veſted in, or to the People of the ſaid State. TO HAVE AND TO HOLD, all and ſingular the ſaid Premiſes, hereby granted, bargained, ſold, enfeoffed, and confirmed, with the Appurtenances, unto the ſaid John Green his Heirs and Aſſigns, to the only proper Uſe and Behoof of the ſaid John Green and to his Heirs and Aſſigns forever. IN WITNESS whereof, the ſaid Parties to theſe Preſents, have hereunto interchangeably ſet their Hands and Seals, the Day and Year firſt above written.

SIGNED, SEALED AND DELIVERED, }
IN THE PRESENCE OF US.

Sarah Wisner

Samuel Dodge

Danl. Graham

FIG. 101.—*This indenture shows the typical fate of the loyalists and their property in New York and elsewhere at the hands of the patriots in the revolutionary epoch*

This fantastic letter puzzled our revolutionary Congressmen, and they died leaving the puzzle unsolved and Beaumarchais unpaid. As a result such letters as this one were addressed to the Continental Congress of 1787:

"To the President of the Continental Congress: I dare hope sir that touched by the importance of the affair, and by the force of my reasons, you will do me the favor of honoring me with an official answer as to the course which the honorable Congress will determine upon — whether to verify my account quickly and pay on that verification like any just sovereign, or at length to appoint arbitrators in Europe to decide the points; . . . or finally to write to me, without equivocation that the sovereigns of America, forgetting my past services, refuse me all justice." [3]

Not only political and diplomatic history, but our industrial history as well, is dependent on letters and records. In working over the boot and shoe industry in Massachusetts before 1873, I have utilized, not only the recollections of old men and women who have worked on handmade shoes in their homes, but also the account books, bills, tools, and lasts that they have found in their attics.

FIG. 102.— *Colonial regimentals*

Under the eaves of an attic in North Brookfield, Massachusetts, I found the account books of the "general store" of Skinner and Ward for 1813 to 1815. The accounts show that between December 21, 1813, and July 10, 1815, Reuben Underwood made $10.90 worth of shoes to put on sale. Doliver and Norwell, joining forces, worked on a larger scale. The same books show that between July 2 and November 1, 1813, they made $155.25 worth of shoes "to be left" at Skinner & Ward's "on account." The account stands as follows:

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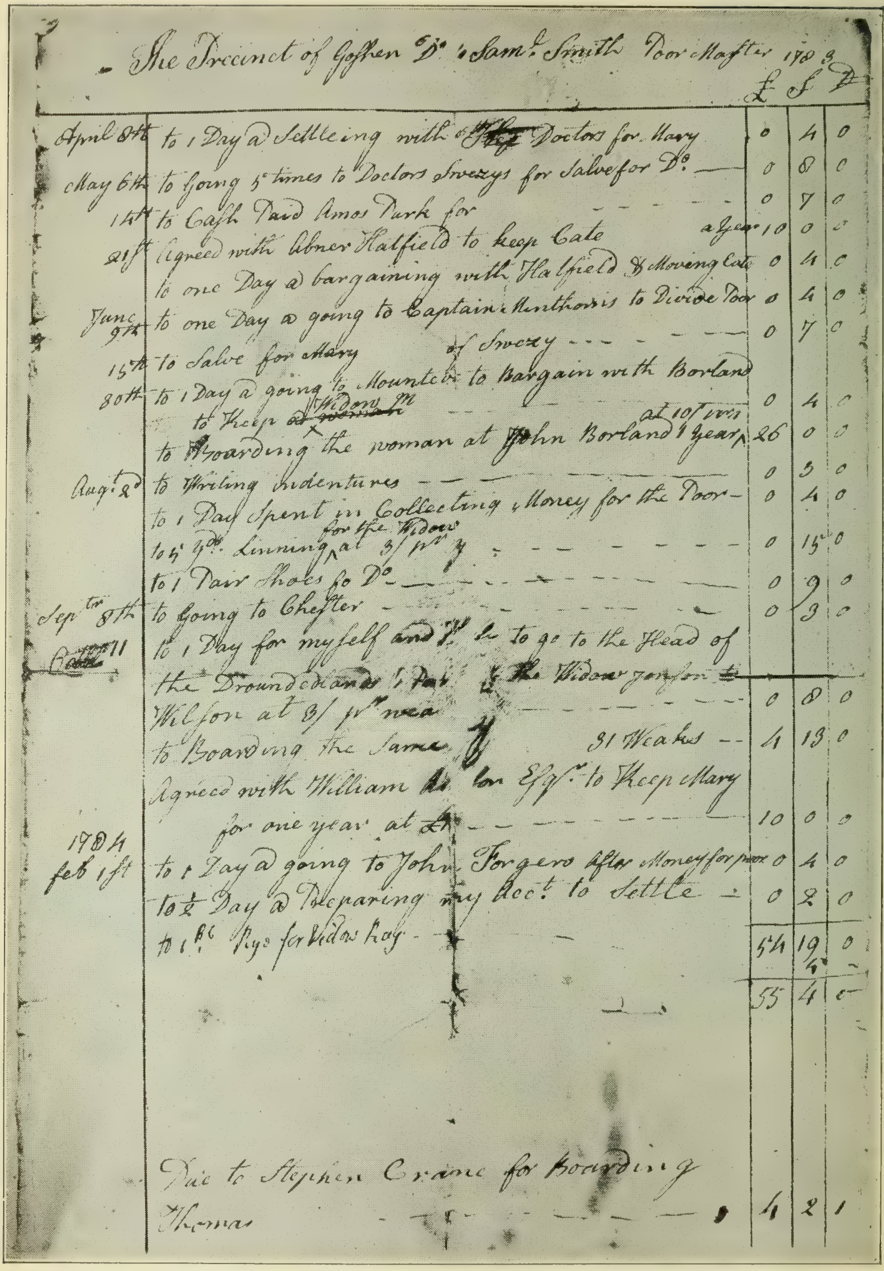
[3] Quoted from "Beaumarchais and the American Revolution." Blanche Evans Hazard. Published by the general Society of the Daughters of the American Revolution. Boston. 1910.



The Precinct of Goſhen Dr. to Saml. Smith Poor Maſter 1783

		£	s	d
April 8th	to 1 Day @ Settleing with ~~Docr~~ Doctors for Mary	0	4	0
May 6th	to Going 5 times to Doctors Swezys for Salve for Do.	0	8	0
14th	to Caſh Paid Amos Park for	0	7	0
21ſt	Agreed with Abner Halfield to keep Cate a Year	10	0	0
	to one Day @ bargaining with Halfield & Moving Cate	0	4	0
June 9th	to one Day @ going to Captain Anthonys to Divide Poor	0	4	0
15th	to Salve for Mary of Swezy	0	7	0
30th	to 1 Day a going to Mounteer to Bargain with Borland to Keep ~~a woman~~ Widow M	0	4	0
	to Boarding the woman at John Borland 1 Year at 10/ wk	26	0	0
Augt 2d	to Writing Indentures	0	3	0
	to 1 Day Spent in Collecting Money for the Poor	0	4	0
	to 5 yds. Linning for the Widow at 3/ pr yd	0	15	0
	to 1 Pair Shoes fo Do.	0	9	0
Septr 8th	to Going to Cheſter	0	3	0
~~Octr~~ 11	to 1 Day for myſelf and [illegible] to go to the Head of the Drowndelands to Put [illegible] the Widow ſon to Wilſon at 8/ pr wea	0	8	0
	to Boarding the Same 31 Weaks	4	13	0
	Agreed with William [illegible] Eſqr. to Keep Mary for one year at £	10	0	0
1784 feb 1ſt	to 1 Day @ going to John Forgers After Money for poor	0	4	0
	to ½ Day @ Preparing my Acct. to Settle	0	2	0
	to 1 Bl. Rye for Widow Hay			
		54	19	0
			5	
		55	4	0
	Due to Stephen Crane for boarding Thomas	4	2	1

FIG. 103.— *This leaf of an old account book of 1783 tells the story of the care of the poor in a New York town before the day of almshouses. The poormaster had to charge for both time and services, as well as for moneys actually expended for the town's wards*

1813		
July 2.	By shoes taken and left..............	$47.79
Aug. 9.	" " 43.54, Aug. 14, shoes 18.72..	62.26
Oct. 4.	" " 1.04, Oct. 16, " 13.50..	14.54
Oct. 27.	" " 29.62, Nov. 11, " 1.04..	30.66
	Total........................	$155.25

This was a good bit of evidence to put with other bits, in preparing the general statement that in scores of little shoemaking towns the transition from bespoke, or ordered, work at the custom shoemaker's to extra, or sale, work came naturally.

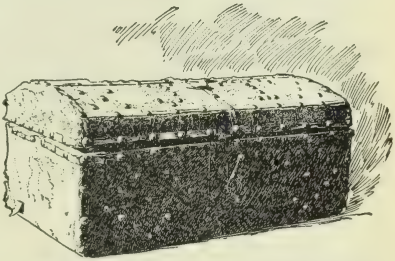


FIG. 104.— *An old-fashioned trunk*

" There were times when the more advanced apprentices or even the journeymen spoiled a pair of shoes started for a definite customer, and these remained on the master's hands to be disposed of. Then there were slack times when the apprentices might fairly be expected to 'eat their own heads off,' to the shoemaker's loss. In such a case the craftsman ventured to make up the stock on hand, to employ this otherwise wasting labor, and then tried to dispose of the shoes in the village grocery store. Since the market was uncertain and slow for this extra work, both stock and labor may frequently have been below the standard used in the custom-made shoes. It might naturally happen that the demands would be more steady and the profits could be relatively higher for this lower cost work, even when it was all done at the direction of the same master shoemaker in the same shop and by the same workers by simply using different standards and different grades of stock. In case the shoemakers lived in villages too far from Boston to attract customers but near enough to send in their surplus product, their attention to sale work would steadily grow. A seemingly typical case, with all its local flavor, can be followed in detail in the bills, letters, account books, and oral traditions of Quincy Reed of Weymouth. He expected to be a shoemaker, just as his great-grandfather William, who landed in Weymouth in 1635, and his grandfather and father had been. In 1809 the father was a master with custom work and probably some sale work for local consumption. As Quincy tells the story: 'My brother Harvey began it by taking chickens to Boston. He had a pair of chaise wheels in the barn, and putting on a top piece, loaded her up and drove to town. He hung some shoes on the chaise and we sold them in Boston. We did not have a wagon then,— I can remember when there wasn't a wagon in this part of the town, and between here and East Abington there was only one pair of wheels. All the shoes (custom-order and extra 'sale' shoes) before we began business were carried into Boston in saddle bags. . . . We hired a store of Uriah Cotting at 133 Broad Street and fitted it up. Then I used to keep a chest of shoes in a cellar near Dock Square and on Wednesday and Saturday would bring out the chest and sell. I got $15 and $20 a day by it in 1809. I was sixteen and my brother was eighteen years old then. We moved into the Broad Street store with two bushels of shoes. I used to cut out what would promise to be $100 worth a day. We couldn't have them made equal to that, but I could cut them. One day I cut 350 pair of foot fronts and tended store besides. Most of the shoes were made by people in South Weymouth. We had nearly every man there working for us before long. Used to bring out the sole leather swung across the horse's back in those days. We didn't have any capital to start with except father's assurance that "the boys are all right and will pay their debts." When we got of age Harvey paid father $1000 for his time and I paid him $3000. By then we had got up a stock of $10,000 and I have the inventory now to prove it. We were getting $2 for the best shoes and $1.25 to $1.50 for the West India shoes.' "

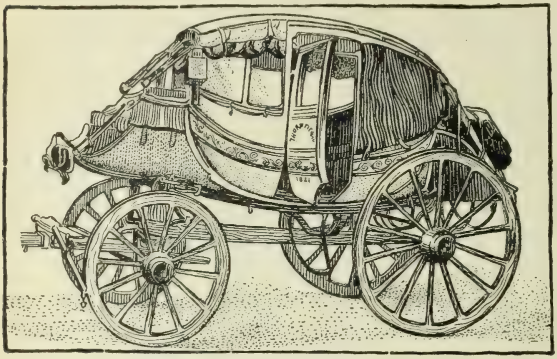


FIG. 105.— *A stagecoach of 1829*

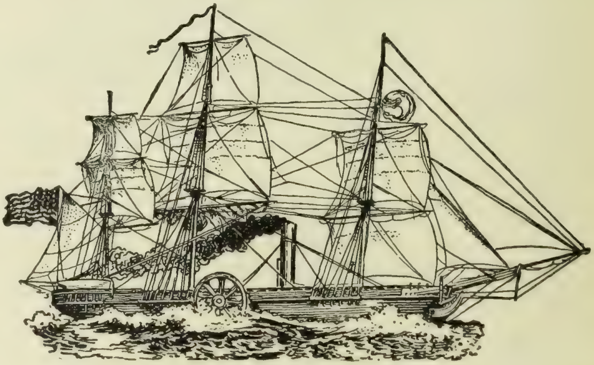
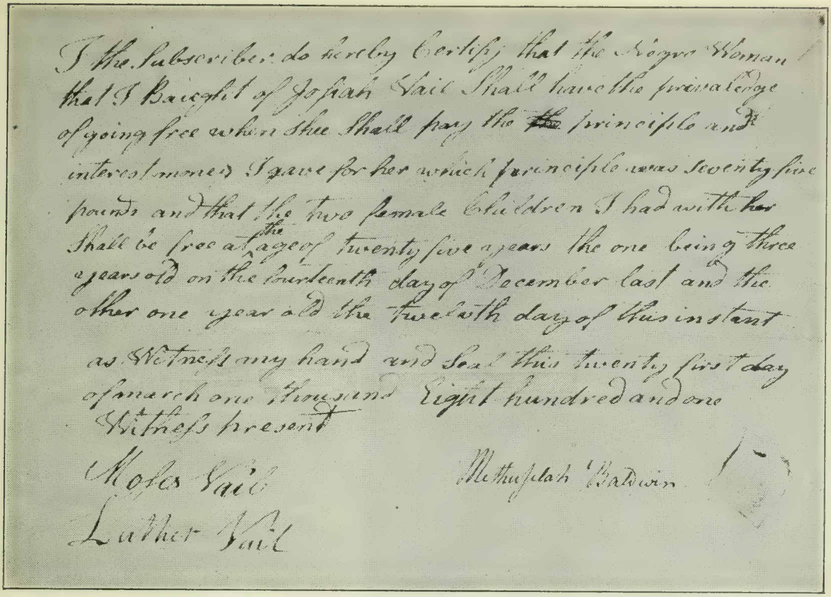


FIG. 106.— *An early steamboat*



I the Subscriber do hereby Certify that the Negro Woman
that I Baught of Josiah Vail Shall have the privaledge
of going free when shee Shall pay the ~~the~~ principle and
interest money I gave for her which principle was seventy five
pounds and that the two female Children I had with her
Shall be free at the age of twenty five years the one being three
years old on the fourteenth day of December last and the
other one year old the twelfth day of this instant
as Witness my hand and Seal this twenty first day
of march one thousand Eight hundred and one
Witness present
Moses Vail
Luther Vail

Methuselah Baldwin

FIG. 107.— *Document concerning the sale and manumission of negro slaves in New York*

The collection of papers from which this last letter is taken are in the ell of the house in Weymouth, Massachusetts, and, although they are carefully docketed and packed in cases, the room itself is too damp for them. The ink is fading rapidly and the sticky yellow mold might make many of you housekeepers shudder. These papers would be safer in a well-lighted, carefully ventilated, historical-society room, where they could be locked up or guarded by a regular attendant who had power and time to show them on demand. Otherwise they should be put into a good case and kept in the main part of the Reed house. They are too valuable for ell or attic. The present mistress of the Reed household told me of her trials in giving the papers space and occasional care, in order to humor the whim first of her old father and then of her brother. She expressed her delight that at

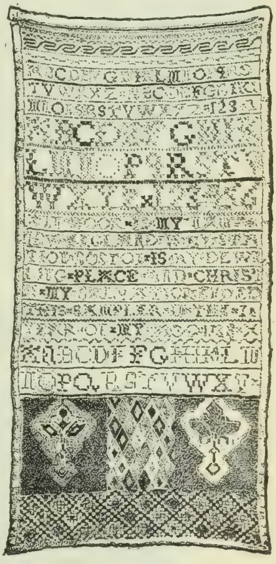


FIG. 108.— *A sampler such as every New York girl made in early days*

last the records were doing some good instead of merely making trouble. I realized as I talked with her that there were two possible viewpoints regarding such records, and I appreciated her willingness to care for them in the future if they would be of any value to others. That is just the idea that I want to pass on to you housekeepers of New York State whose attics have always seemed to be so hopeless and are now threatening to grow more so with the accumulation of coming years. You may groan involuntarily at the suggestion of sorting out, saving certain of the things, and then planning to keep them more carefully in the future. Yet, after all, it is just a case of planning. Decide on what is rubbish, and then decide to destroy the rubbish and keep the remainder.

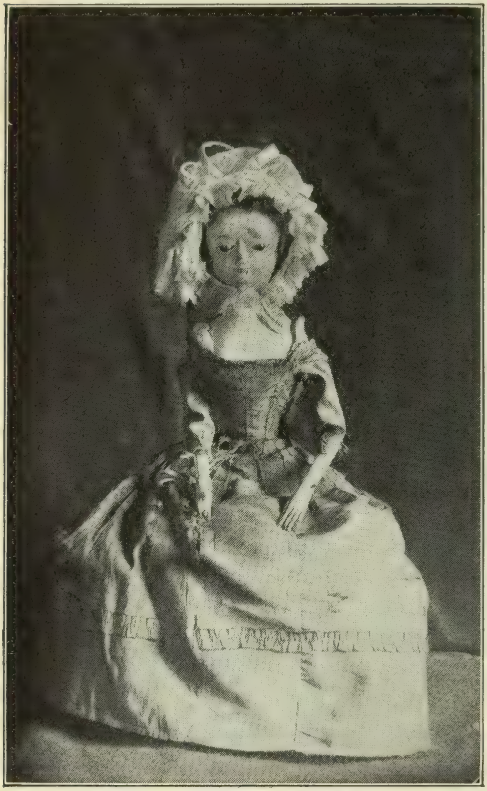


FIG. 109.—*A doll two hundred and fifty years old*

In fancy I can shut my eyes and go up to your attic with you and see things as they are. Over there is the first child's cradle and the doll house of the daughter who went away to normal school and who now is out west teaching. You like to sit down in front of the toy and recall

FIG. 110 a.— *New Amsterdam in 1673*

how Marion looked as she played with it in old days. Because you enjoy being able to see this doll house, you resent your husband's action in placing pieces of broken furniture, old mattresses, some pillows, and a comfortable on top and in front of it just in order to save floor space. The business books of your husband and of his father, who kept the village grocery store, seem useless trash that take up too much floor space, and so you have pushed them back farther and farther under the eaves. Won't you see whether these accounts are becoming damp and moldy there? If they are, don't drag them out and burn them as you threaten to do; just spread them in the sunlight near the window, dry them, and then take that comfortable off the playhouse heap and cover the books carefully. Find all the business papers that you can, written between 1775 and 1875 — not only account books, but letters, files of bills, and orders; pack them in a wooden box and label them plainly. Let me know some time where they are, what business they represent, and whether you would like to let any one look over and use the older ones with or without mention of names just as I have used the papers that I have quoted.

Then go through the trunks and boxes in search of old clothes. See whether any of them belong to your husband's Dutch ancestors or to some soldier of the Revolutionary War. Why not sponge off the garments, place them in the sunshine so that no moths will be attracted to eat them, and then press and label each piece before putting it back into the trunk so that when your children are writing and staging a historical play, such as the "Good Angels of Valley Forge" or "The Dutch Patroon's Delights," you can furnish original costumes for them? If you can, find some more clothes belonging to children and women of any century or any decade of the past. I have always been glad that this picture of Madam Riedesel has been kept, showing the clothes that the dainty diplomatic lady wore after the battle of Saratoga. Her interesting account of that battle, and of General Schuyler's courtesy to her and her chil-

FIG. 110 b.— *New Amsterdam in 1673*

dren, are made the more fascinating to us by seeing in this picture the very woman before whom General Schuyler made his polite bows.

Save any bonnets, lace shawls, or mits of your great-grandmothers and great-aunts, or even of your grandmothers and own aunts, because two centuries from now they in turn will be "over two centuries old." Hunt for dolls and see how they look. Next, in the drawers and pigeonholes of that old secretary in the corner, hunt for paper money, either the continental currency or the script of the early nineteenth century, and for picture cards advertising the sailing of vessels down the Mississippi River or around the Horn. You may find advertisements of Connestoga wagons represented as being the best and only proper means of conveyance from York State to the fertile fields of Iowa and to the gold mines near the Pacific coast. Do you know whether any of your family took shares in the Erie Canal or in any of the early railroad projects in central New York? All documents relating to that business would be likely to give you pictures of early locomotives and of old stagecoaches in contrast. Wouldn't your sons and grandsons and your coming great-grandsons be delighted if you and your husband could find an old flintlock, such as they used in the war of 1812, and the uniform of some one of your name who fought in both the Mexican War and the Civil War? Was your brother by chance a drummer boy in the New York 22d Regiment? Can you find any of his regimentals? Even a cap and a drumstick would be worth finding and saving.

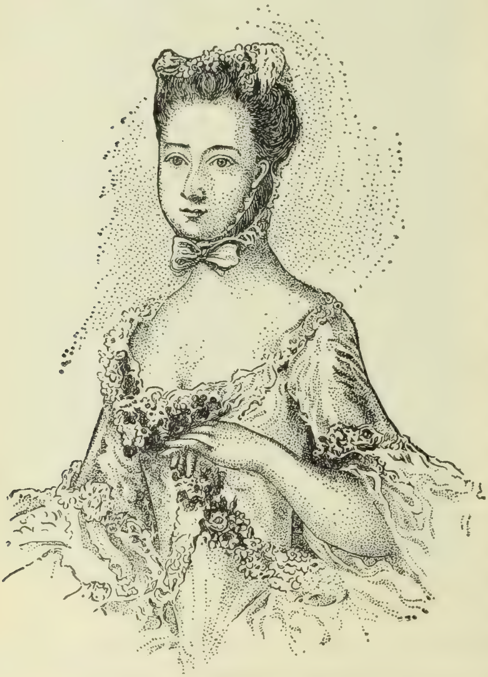
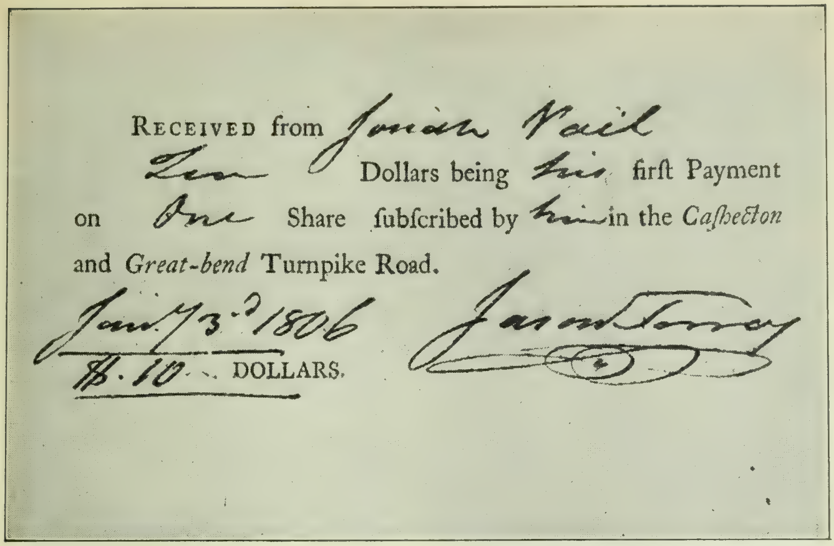


FIG. 111.— *Madame Riedesel*

Perhaps you will discover the quilting frames and the old quilts that used to give, not only comfort to sleepers, but also happy waking hours to dames and maidens who worked and gossiped at quilting bees. Don't let the parts of the low flax wheel get lost or broken. Can you find the cards, swifts, and reels for preparing the wool after your ancestors



RECEIVED from Josiah Vail
Ten Dollars being his firſt Payment
on One Share ſubſcribed by him in the *Caſhecton*
and *Great-bend* Turnpike Road.
Jany 3d 1806 Jason Torrey
$·10 .. DOLLARS.

FIG. 112.— *This document shows how early transportation projects were financed in New York State*

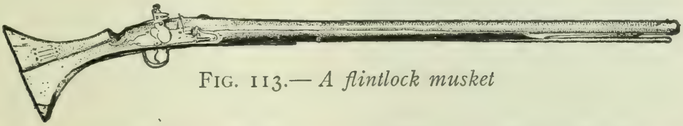


FIG. 113.— *A flintlock musket*

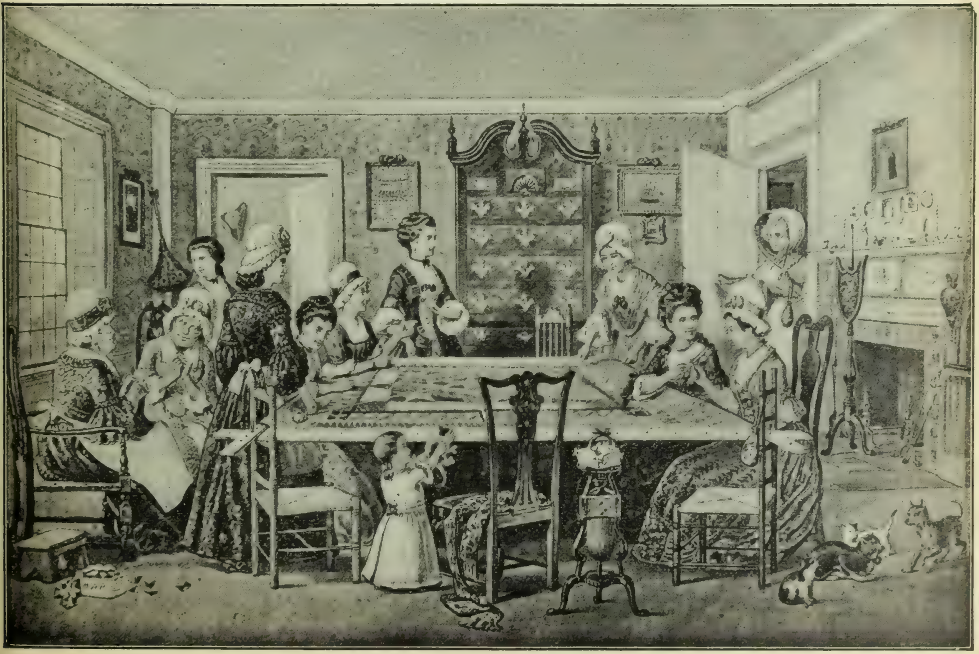


FIG. 114.— *A quilting bee*

had sheared it off the backs of the sheep, which used to browse over there on the hills that you see now from the attic window? Have you by happy chance a big hand loom at which your mother watched your grandmother weave homespun? Wouldn't you like to have your Cornell Study Club look up the old ways of spinning and weaving, and of dyeing the woolen and cotton as well, and then in the winter months devote some club afternoons to weaving on your loom? If you can make a common fund of artistic products of high standard and value, they would find a good sale. One community after another could build up and support such by-industries for farmers' wives. Before long, perhaps, another Reading-Course lesson will be devoted to just such a plan. Meanwhile, in this lesson, let me beg you to search and save that which otherwise may soon be lost, not only to you, but also to coming generations. In the discussion paper I am putting some questions which you may be ready, and perhaps eager, to answer after your search is over. My earnest hope is that your housecleaning this year may not be made more arduous, but more interesting, as interesting as a game to you, through our urgent plea and pertinent questions.

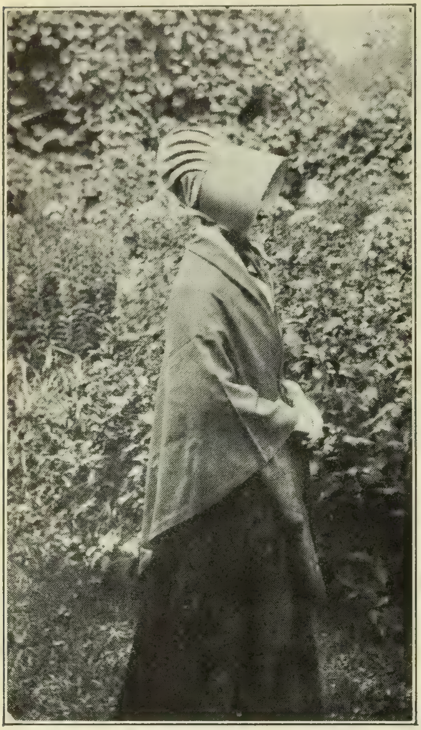


FIG. 115.— *A Quaker costume*

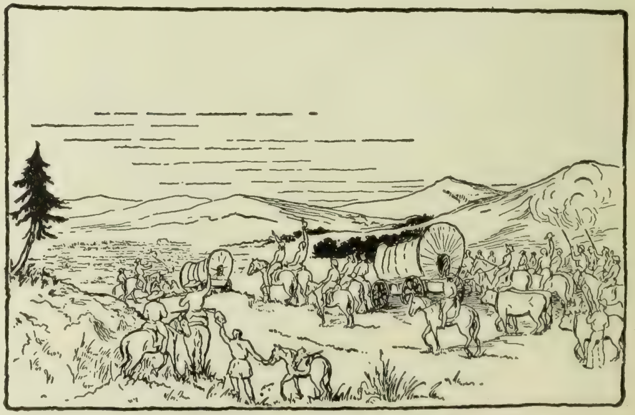
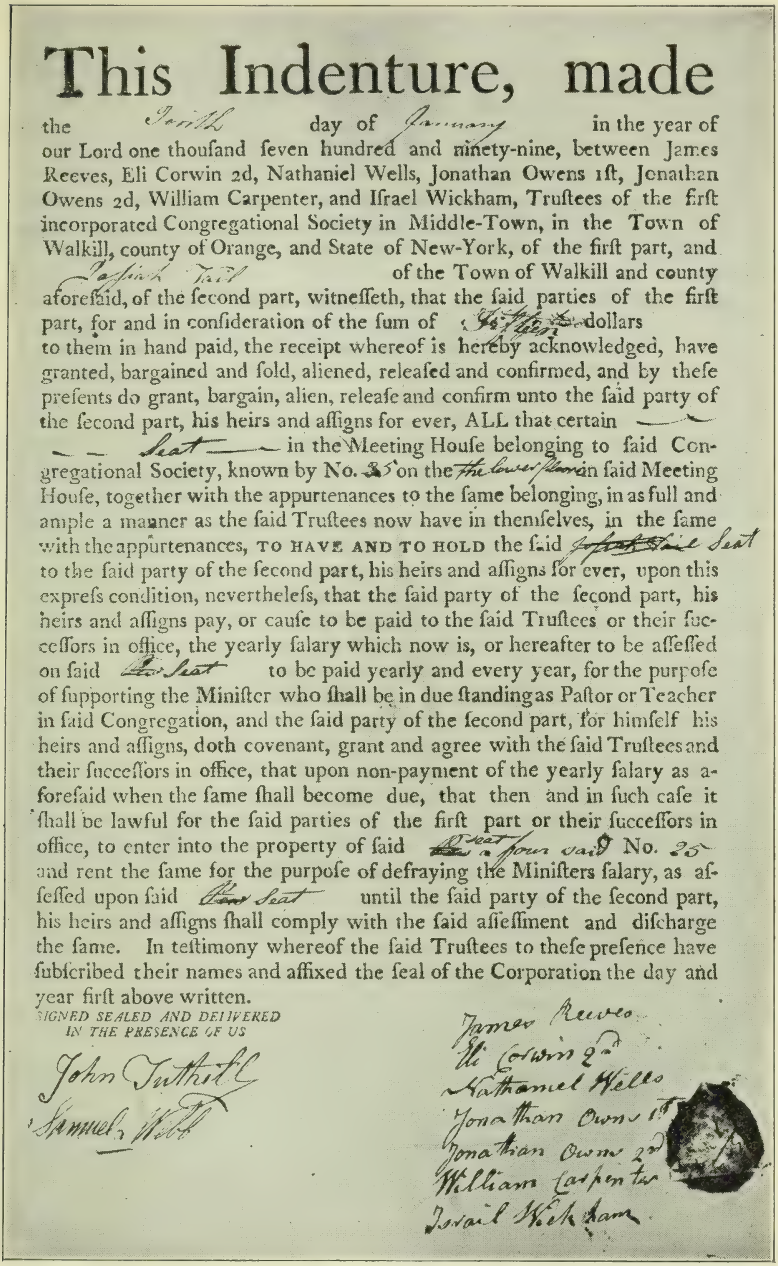


FIG. 116.— *Connestoga wagons on the Oregon trail*



This Indenture, made the Tenth day of January in the year of our Lord one thouſand ſeven hundred and ninety-nine, between James Reeves, Eli Corwin 2d, Nathaniel Wells, Jonathan Owens 1ſt, Jonathan Owens 2d, William Carpenter, and Iſrael Wickham, Truſtees of the firſt incorporated Congregational Society in Middle-Town, in the Town of Walkill, county of Orange, and State of New-York, of the firſt part, and Josiah Tait of the Town of Walkill and county aforeſaid, of the ſecond part, witneſſeth, that the ſaid parties of the firſt part, for and in conſideration of the ſum of Fifteen dollars to them in hand paid, the receipt whereof is hereby acknowledged, have granted, bargained and ſold, aliened, releaſed and confirmed, and by theſe preſents do grant, bargain, alien, releaſe and confirm unto the ſaid party of the ſecond part, his heirs and aſſigns for ever, ALL that certain Seat in the Meeting Houſe belonging to ſaid Congregational Society, known by No. 25 on the the lower floor in ſaid Meeting Houſe, together with the appurtenances to the ſame belonging, in as full and ample a manner as the ſaid Truſtees now have in themſelves, in the ſame with the appurtenances, TO HAVE AND TO HOLD the ſaid ~~Josiah Tait~~ Seat to the ſaid party of the ſecond part, his heirs and aſſigns for ever, upon this expreſs condition, nevertheleſs, that the ſaid party of the ſecond part, his heirs and aſſigns pay, or cauſe to be paid to the ſaid Truſtees or their ſucceſſors in office, the yearly ſalary which now is, or hereafter to be aſſeſſed on ſaid Seat to be paid yearly and every year, for the purpoſe of ſupporting the Miniſter who ſhall be in due ſtanding as Paſtor or Teacher in ſaid Congregation, and the ſaid party of the ſecond part, for himſelf his heirs and aſſigns, doth covenant, grant and agree with the ſaid Truſtees and their ſucceſſors in office, that upon non-payment of the yearly ſalary as aforeſaid when the ſame ſhall become due, that then and in ſuch caſe it ſhall be lawful for the ſaid parties of the firſt part or their ſucceſſors in office, to enter into the property of ſaid seat a pew said No. 25 and rent the ſame for the purpoſe of defraying the Miniſters ſalary, as aſſeſſed upon ſaid Seat until the ſaid party of the ſecond part, his heirs and aſſigns ſhall comply with the ſaid aſſeſſment and diſcharge the ſame. In teſtimony whereof the ſaid Truſtees to theſe preſence have ſubſcribed their names and affixed the ſeal of the Corporation the day and year firſt above written.

SIGNED SEALED AND DELIVERED
IN THE PRESENCE OF US

John Tuthill
Samuel Webb

James Reeves
Eli Corwin 2d
Nathaniel Wells
Jonathan Owns 1st
Jonathan Owns 2d
William Carpenter
Israel Wickham

FIG. 117.— *A New York parish document, which will help students of to-day to understand the old church economy*

ACKNOWLEDGMENTS

The following acknowledgments are made for illustrations that have been courteously loaned to the writer:

Figs. 102, 104, 105, 106, 108, 111, 113, 114, 116, loaned by the Macmillan Company, New York City.

Figs. 97, 98, 99, 100, 110, loaned by Silver, Burdette & Co., Boston.

Figs. 101, 103, 107, 112, 117, loaned by Glenroi Vail, of Romulus, New York.

Fig. 115, loaned by Miss M. Jacobs, of Auburn, New York.

Fig. 109, loaned by Miss Louise Whittaker, Ithaca, New York.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE
NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
Entered as second-class matter at the post office at Ithaca, New York
W. A. STOCKING, Jr., *Acting Director* A. R. MANN, *General Editor*
COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 61 APRIL 1, 1914 **RURAL LIFE SERIES No. 7**

ATTIC DUST AND TREASURES

DISCUSSION PAPER

Answers to the following questions by all those who receive this lesson will help us to begin our work of finding, systematizing, and using effectively the facts in the history of early industrial life of communities throughout the entire State of New York.

1. Have you an attic? Have you an ell which you use as a storehouse?

2. Is your attic warm and dry enough to work in during the spring, and cool enough to read and work in during the summer?

3. At spring house-cleaning time this year, will you look for old account books, letters, files of bills, and the like, and will you inform the College as to what business they concern and their range of dates?

4. Have you any paper money used in colonial times or before 1870?

5. Have you files of newspapers of town, county, or State? Have you the ballots used in any town meetings or on election days?

6. Are there any town or church records which have been kept in your town or parish?

7. Were any of your ancestors Dutch? Quaker? Indian? Have you any of their clothes? Have you any picture in black and white or in color of any such ancestors?

8. Were any relatives of your name or of your blood in the Revolutionary War? in the War of 1812? in the Civil War? Have you kept any of their diaries, arms, or clothing?

9. Have you access to a genealogy or to any records of your family that would aid in gathering details and in getting the proper settings for any of your ancestors?

10. Have you any implements of home industries of earlier days, such as cards, spinning-wheels, looms, swifts, reels, or candle molds?

11. Did any of the women of your family spin extra yarn or weave extra pieces of woolen, linen, or cotton cloth for any customers or local stores, working in their own kitchens, furnishing their own stock of raw material?

12. Did any of them "take out" from some central shop shoes or boots to bind, close up, and make, as the women of Massachusetts did from 1790 until the factory hands supplanted them about 1850?

13. Have you any quilts or homespun table linen of beautiful design, which you would like to copy?

14. Would you like to aid in developing in your home community or town some by-industry that farmers' wives and daughters could undertake in addition to their regular work, doing this new work so well that it could be marketed as is the lace, embroidery, and weaving made by women of Deerfield, Massachusetts, of Battle Harbor, Labrador, and of various parts of Denmark and Ireland?

15. Would the women and the young girls of your community or of your club enjoy working as women used to work in the colonial quilting bees and corn-husking parties on some joint production of your handicraft that would have a market value if properly done?

Name..

Address..

Date..

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COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No 63 MAY 1, 1914 RURAL LIFE SERIES No. 8

THE YOUNG WOMAN ON THE FARM[1]

MARTHA FOOTE CROW

Introduction by

MARTHA VAN RENSSELAER

The Department of Home Economics at Cornell University is interested in the country girl in America. Much is done for the farmer's wife, in the belief that she shares, to an equal degree with the farmer himself, the opportunities and responsibilities of the farm in building up rural progress. At the present time the girls are deciding whether they will leave country

FIG. 118.—*The country girl's play*

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[1] A discussion of Country Life for Young Women, with a questionnaire to be returned by the reader.

life for city occupations. The opportunity for a young woman to earn money is greater in the city than in the country, and the woman of to-day has become an economic factor to be considered in the business world. Unless she marries she must have money of her own, and even if married she is not averse to handling a share of the income. *Shall the girl who desires financial independence go to the city in order to earn this income, or shall she find industrial opportunity in the rural community?*

Another tendency with the country girl is to go where she will have more company and recreation than she finds in the country. Can rural life be developed so that she will find enjoyment there, rather than be compelled to seek it in the cities, where the game of life is harder to play and where social opportunity such as can be found among the friends at home will be harder to obtain? It must be granted that the country girl should have relaxation and recreation if she is to become a well-rounded, useful woman. *What can be developed in the country that will increase the play spirit and standardize country games?*

As the business of farming progresses women are needed to take care of the home life, which must be developed in larger degree as the business increases. Most parents desire that their daughters should not work so hard as they themselves have been accustomed to work, and with this in view they have sacrificed much in order to enable the young persons to leave home. Has not that policy been a mistaken one sometimes? Is not the abounding life of the country girl needed in order to standardize household duties on the farm, to simplify farm home labor, and to give new life to the social forces of rural districts? Should she not give time and study to learning how to do this? What are the possibilities of labor-saving devices in the farm household? The boy will not stay at home with the old-fashioned plow; neither will the girl stay by the broom and the dish pan if the vacuum cleaner and the well-drained sink can be obtained.

Many girls and boys are turned away from the farm because they hear mother and father say so often that farming is a poor business. The child is made to feel that storekeeping or doctoring or some other occupation is much better than farming. If the farmer does not take pride in his calling, his children will not. If the mother finds only drudgery in her household duties, the daughter may partake of the same spirit. The mother's point of view has been influenced by weariness and discouraging conditions. The daughter may find a rosier hue in life than her mother does, because she is less fatigued and weather-beaten. But we grow weary much sooner when our attitude of mind is unhappy toward our piece of work than when it is happy. *Shall we dignify farm housekeeping by good equipment and scientific management, and create in young women a zest for the work that calls to them?*

THE YOUNG WOMAN ON THE FARM

MARTHA FOOTE CROW

In the present widespread movement for country-life progress the question that the young woman will promptly ask is, Am I doing my share? Professor G. W. Fiske says, in "The Challenge of the Country," that "men can never solve the rural problem without the help of women." Such a statement as this will have a strong appeal to the younger women, for the future and all its possibilities lie in their hands.

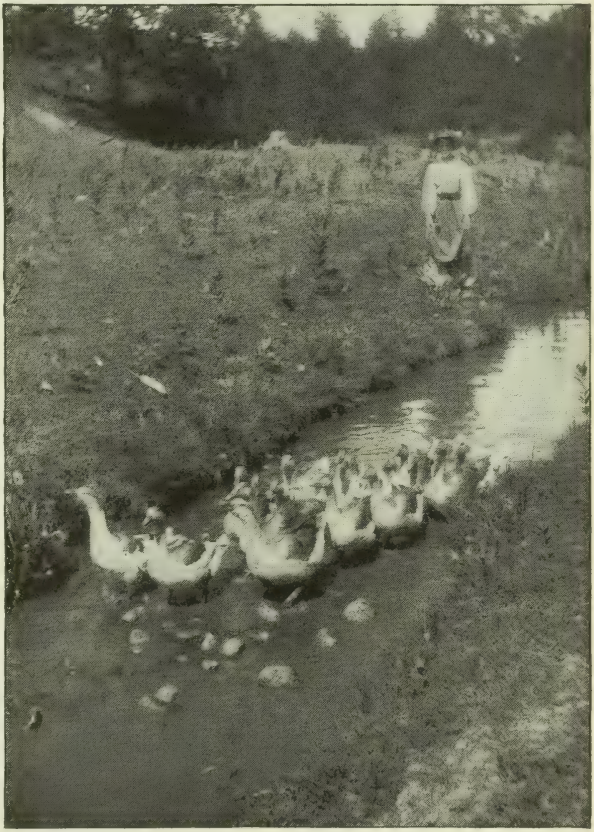

FIG. 119.—*A possible occupation*

VALUE OF THE COUNTRY GIRL TO THE FARM

We wonder whether the country girl realizes how important her place is in the structure of the rural community. She has a very definite part there, and it is a valuable one. As the acknowledged maker of home comfort and the foreordained leader of sociabilities in the rural neighborhood, she has a service that no one can take from her hands. In fact, what the young woman on the farm does or does not do, the part that she takes in the social life and in the organizations in her vicinity, her recreations and her work — all her activities, in fine, have a bearing on the refinement of the farm home and the farm community. On the younger women, therefore, rather more than on any other class, depends the ultimate success of farming as a satisfactory community life.

WORK AT THE FARMSTEAD

We know that there is a large amount of work to be done in the farm home, but farmers' daughters in this country are very brave and capable and ready to lend a hand. As a general thing, the young woman has it in her power to make her work all drudgery or she can transform it into a pleasure. How to do this is for her to study out.

THE FARM AS A BUSINESS

It used to be believed and said that the business of the farm ought to be wholly in the hands of the farmer and his sons. It is now understood that the work in the house is an essential part of the farm business, and that in the remainder of the labor of the farm the wife and the daughters have just as keen an interest as have the father and the brothers. Moreover, many a woman is nowadays undertaking the operation of the farm itself, and is making good, too.

In a late novel, entitled "The Wind before the Dawn," a picture is drawn of a woman who took hold of a farm that had been mismanaged. She brought it up to an almost ideal state of productivity; she used good judgment in planning; she kept things shipshape — and she succeeded. There are many counterparts to this experience in real life, and they are found in all parts of this country.

It is therefore possible for us to believe that every daughter can grow to be an aid to her father in his business as a farmer, and that gradually she may enter into full responsibility for some part of the farm business; or that perhaps, if it should ever be necessary for her to do so, she may become a successful manager for all the activities of a farm.

NEW INDUSTRIES

In the farm home of early New England days, the labor of the women included not only all the common work that falls to the hands of women in the present day, but also the spinning and weaving, the dyeing and fulling, the dressmaking and tailoring, the candle-making and soap-making, and many other industries that now, along with those mentioned, have gone out of the farmhouse and taken up their abode in the factory. In those days the hands of the women were full of wage-earning labor.

To-day also there are many women, and especially young women, who feel that they need some addition to their earning opportunity, and to these many doors are now opening. The revival of our ancient industries offers an alluring prospect, although this may not be the most practical field.

Is it not generally the most sensible thing to take the opportunity that stands by one's own garden gate? Why not, then, make a careful study of the farm conditions right at hand, in order to find out whether there may not be some fruit or vegetable product going to waste that can be utilized by the excellent modern methods of canning and preserving, so

FIG. 120.—*The daughter's inheritance*

that the family may be economically supplied with delicacies all the year round and some extra quantities may be sold that will bring a good income? Something like this should be possible for any energetic and capable farmer's daughter.

Perhaps, again, as a result of this discussion of the young woman's duty and opportunity in the rural community, we shall have many ingenious suggestions from girls all over the country as to clever ways of earning money. This is what we greatly desire; and to this end may we ask that question No. 6 on the discussion paper be answered with considerable fullness, that no good suggestion may be omitted?

There are now over six million country girls in our land. Does it not look as though this body of eager, buoyant young women might add something valuable to the welfare of our rural life, if they could but be of one mind as to the formation and expression of their ideals and as to the practical means of realizing those ideals in actual life?

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Extracts from some letters from farmers' wives

"Now that we farmers' wives have learned so many things in our reading-courses, such excellent truths about the chemistry of food and about sanitary conditions, have been taught how to work, how to rest, how to beautify our homes, how to stay young and to be lovable and lovely — I would like to talk a little about how we may keep our children in the rural home.

"As a beginning I would suggest that no one should ever, in their hearing, deplore the dullness and drudgery of farm life. Rather let us teach them from infancy to prize its pristine quiet and peace. I would dress the boys and girls as well as my means would allow and in no way different from the young people who live in the town. I should hope that my boy would never hear the remark made concerning him, 'He looked like a regular old farmer!' As far as possible I should let the boys and girls do what they wanted to do. If they wanted to plaster the walls of their rooms with posters that did not appeal to my taste, I would make quarts of paste for them. If they wanted thirteen pillows for a cosy corner, I would cut up Aunt Caroline's feather bed for them. I would read with them the books that they liked rather than the books that I thought they ought to like. And if they gloried in some wild tale of the sea, I would have patience, knowing that the time would come when they would enjoy 'The Chambered Nautilus' and 'The King of the Golden River.'

"Why do so many boys and girls want to leave the farm? It is because, unless the parents are thoughtful in regard to rearing and training the young minds, the children on the farm fail to observe the beautiful possibilities and opportunities of the country life; are apt to think that there is too much work for the amount of profit, and no time for the sports so natural to children. A boy is so handy on the farm to run and do this, that, and everything, that the time goes without thinking that all work and no play is not a wise and profitable way to keep the children on the farm."

* * * * * * * * * * *

"As I look at it, there are the same amusements for girls that there are for boys in the outdoor life. The girls enjoy caring for animals as well as the boys do; also they like the care of flowers, and even the plants in the garden and all over the farm; and they are more inclined than the boys are to see the beauties of everything in nature. Besides, the girl can combine the life in the home with the life of nature, thus having the better part.

"It seems to me there is an erroneous idea that when a woman reaches mature years thoughts of reading, and of the development to be gained through it, should be put away along with other childish things. This idea is sufficiently widespread to give a feeling of separateness to the sensitive woman who cherishes these ideals. Some knowledge of botany, geology, and astronomy are for the mother particularly desirable in order that she may interest her children in nature. It is seldom, indeed, when on a starry night I do not remember with keenest satisfaction that my mother taught me to know Orion and some other constellations when we looked out upon the heavens. A woman, if she cannot read much, can read a little. She can pore over a favorite book, a poem, or even a sentence till it becomes a part of her very being. Culture depends not so much on multitudinous opportunities as on making the fullest use of what we have. The problem of life consists in learning to make the most of all things, whether they be material or the abiding things of the spirit."

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COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 63 MAY 1, 1914 **RURAL LIFE SERIES No. 8**

THE YOUNG WOMAN ON THE FARM

DISCUSSION PAPER

In the future issues of the Reading-Course for the Farm Home we hope to help in furnishing opportunity for farm girls to earn money at home and to find recreation and education for farm home-making. The Department of Home Economics asks the young women of the country to answer the questions on the accompanying discussion paper. The readers are asked to write anything that they like, in addition, which will show what their interests are and will make it clear what the American country girl of the future desires for contentment and usefulness. There need be no fear that the name of any person will be made public. The correspondence will be considered personal. Will you help us in our plan by answering the questions and returning the discussion paper to the Department of Home Economics of the New York State College of Agriculture, at Cornell University, Ithaca, New York? If we receive these answers we hope to be ready to send you some suggestions as to contests and recreation clubs, some outlines for pageants, and some new ideas for country industries. Address Supervisor, Reading-Course for the Farm Home, New York State College of Agriculture, Ithaca, New York.

1. What are the reasons, in your opinion, for attractiveness of farm life?

2. Give reasons why one might desire to leave the farm.

3. a. In your home what share have you in the housework?

b. What home conveniences facilitate your work? (Running water, modern labor-saving devices, and the like.)

c. What would you suggest as an addition to the equipment in order to make housekeeping easier?

d. Do you take part in any meetings or movements to promote better housekeeping?

4. a. What forms of recreation, what outings, and what amusements do you have?

b. Can you drive the horses and do you have the use of a conveyance?

c. Do you yourself ride the bicycle or drive the automobile?

d. Do you play games in the family? Which games are most enjoyed?

e. Are there many young people in your neighborhood? How often do you have some kind of social gathering?

f. Where does social life center — about school, church, grange, or homes?

g. What facilities for a social center are there (hall, gymnasium, playground, grove, gardens, et cetera)?

h. Are there enough young persons to form a social, literary, or study club?

i. What social gatherings are there exclusively for the girls in your neighborhood?

5. a. Please give the names of some books that you own, and say which you read with most delight.

b. What interferes with reading?

c. How far is it to the nearest public library? How often do you use it?

d. In your home evenings do you read aloud from some interesting author?

e. What book of that kind have you thus read together of late?

f. What musical instrument have you in your home? What songs do you sing together oftenest in the family? What songs or collection of songs do you possess?

g. What papers and periodicals are taken in your family?

h. Do you personally take any periodicals? What are they? If you could select, what would they be?

i. What other cultural interests have you?

6. a. What ways have you of earning money?

b. Is any special sum set apart for your own use?

c. If you do not mind doing so, will you say how much it is, and also state how you spend it?

d. Have you any pecuniary share in the farm, or do you own any livestock?

e. Does your sharing in this ownership make you have more enthusiasm for the success of the farm?

f. Would you like to know of more ways of earning money?

7. a. How much study do you give to the problems of farming as a business?

b. How much to the art of home-making as a special profession for women?

c. What special training have you had in the science of agriculture or in home economics?

d. What study have you made of the history of the family or of the laws governing women's property?

e. What forms of nature-study especially interest you (trees, birds, ferns, mushrooms, wild flowers, garden flowers, et cetera)?

f. To what extent does your library aid you in those studies?

g. Have you a flower garden? Who cares for it?

8. a. What aid do you give toward social organizations of any kind—the church, the school, the public library, the Y. W. C. A., the Campfire Girls, the Cornell Study Club, the Federation for Country-Life Progress, or any society or club for social enjoyment or intellectual refreshment?

b. Do you take part in the bread-making, sewing, or stock-raising contests, in pageants, or play carnivals, or in any conference on country-life betterment?

9. Please write, on another paper, a description of a typical day of your life.

10. Will you please state:

1) Your age (between fifteen and twenty; twenty and thirty; over thirty).

2) Size of the farm on which you live (number of acres).

3) General physical condition of the farm (hilly, stony, fertile, productive, kind of product).

4) Number of inhabitants in the rural village where you live.

5) Distance of your farm from a village or town.

Name...

Address...

Date...

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COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 65 JUNE 1, 1914 RURAL LIFE SERIES No. 9

FARMHOUSE AMUSEMENTS FOR GIRLS AND BOYS

BLANCHE EVANS HAZARD

With the help of this pamphlet the girls and boys of New York villages and towns can lay in a stock of ideas for winter enjoyment while their fathers and mothers are putting by provisions for winter. Whether they are already grouped in corn clubs or canning clubs, where activities are greatest in spring, summer, and autumn, or whether they are unorganized except as the sons and daughters of grange members, they can plan a winter's program of pleasure and profit by letting their leader help them in writing and staging historical plays. Perhaps at first sight this may seem to you young people like a prodigious and impossible task. But try it, and you will see that it is not only perfectly possible but very entertaining as well.

FIG. 121.— *Mounted crusaders on their way to the Holy Land*

Let me give you first, for example, the text and staging directions for a play called " The Crusaders' Return to Beauchamp Manor," which was written and given in 1913 by a group of students fourteen to seventeen years of age. The play will help you to visit in imagination a scene of farm life in England in the twelfth century, toward the close of the so-called King Richard's crusade to the Holy Land. By enacting the scenes, you will give to your fathers, mothers, and all the people of your community whom you invite to see your play, a vivid idea of the changes in English farm conditions which were brought about through the loss of life in the crusades and through the knowledge of customs and inventions gained by those survivors who came home again to their quiet agricultural life in England.

No attempt has been made by older persons or more skilled writers to remold or revise this text. It is the spontaneous natural outcome of youthful interest; and as such it will appeal to other young persons and will furnish, it is hoped, a definite example to be followed by them in turn.

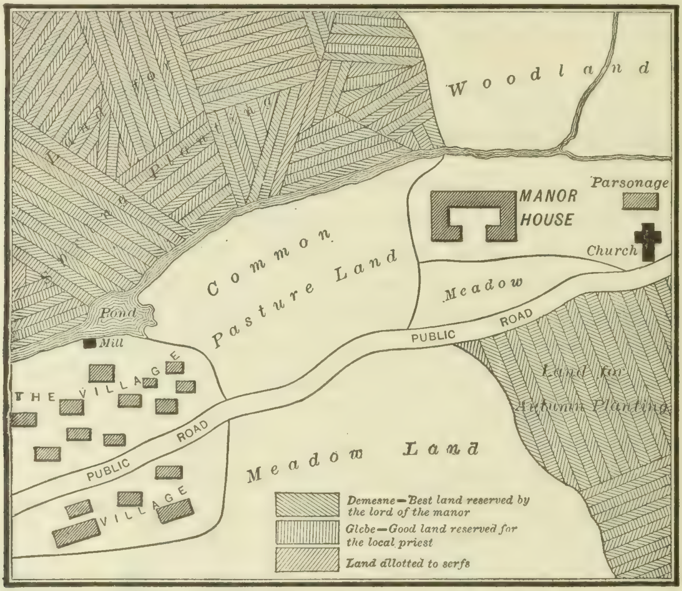

FIG. 122.— *Plan of a medieval manor*

THE CRUSADERS' RETURN TO BEAUCHAMP MANOR

(*Depicting the farm life of the Middle Ages*)

PERSONS REPRESENTED

Lord Beauchamp, *away on crusade*
Lady Beauchamp, *at home in the manor house*
Rowena,
Eleanor, } *daughters of Lord and Lady Beauchamp*
Wolfred Beauchamp, *away on crusade with his father*
Father Lucas, *a village priest*
Brother Malvoisin, *a wandering French monk*
Godfrey Longwood, *a villein away on crusade*
Margaret Longwood, *wife of Godfrey Longwood*
Seth, Adam, and Rosalind Longwood
The Grandmother
Hans Sesamman, *a merchant from Ghent*
Cedric Villiers, *a villein away on crusade*
Edith Villiers, *wife of Cedric Villiers*
Edward Dale, *a villein away on crusade*
Jessica Dale, *wife of Edward Dale*
Gurth,
William, } *villeins*
Robert,
Women, youths, children of the village

ACT I

Scene 1

SCENE.— *In front of manor church. People are gathered there with field implements in their hands. Jessica Dale, Margaret Longwood, Gurth, Robert, William.*

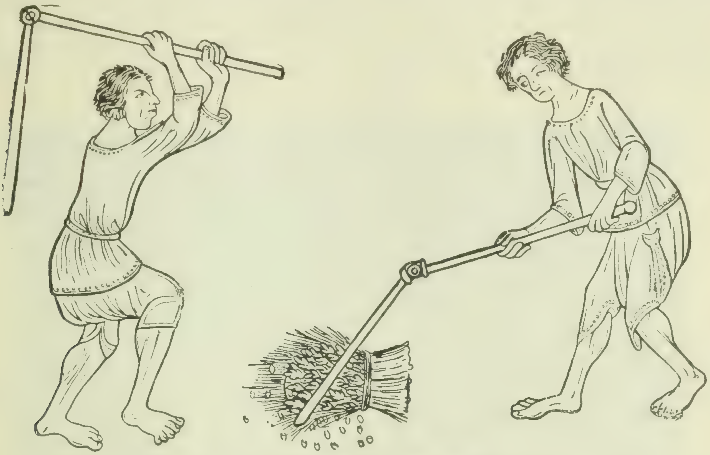

FIG. 123.— *Threshing in the Middle Ages*

GURTH. Methinks my dream of yesternight portends some evil news.

ROBERT. This day is the merchant from Ghent due. Haply from his lips may come news of our brave warriors.

Enter Hans Sesamman in great haste

VILLAGERS. All hail, good messenger!

HANS. Is this Lord Beauchamp's manor?

VILLAGERS. Yes, yes. Hast news of him?

HANS. Alack the day, good people, that I should tell such news!

GURTH. Kind sir, if you have aught to tell, speak at once.

HANS. My good people, it is sad, sad news that I bring you from the Holy Land and the crusaders.

VILLAGERS (*excited*). What, what, bad news from the Holy Land?

WILLIAM. How is that? Surely not from our crusaders?

HANS. It will be a great blow to you all. Yes, yes, indeed, it is from the crusaders. Not one man, as yet known, has lived to tell the tale. There is an entire loss of life among the followers of Richard the Lion-Hearted.

VILLAGERS. What! Not one saved?

WILLIAM. Surely some were saved.

HANS. No, not one. It is only a fortnight since I got that news from the Holy Land by a merchant come direct from there. They died for a good cause.

JESSICA. Were Lord Beauchamp and his son killed?

HANS. It is so said, but, by my faith, I hope it will prove false.

(*The villagers crowd about the merchant, all asking many questions, which he answers to the best of his ability.*)

MARGARET. But, my friends, who will break the sad news to my Lady Beauchamp?

VILLAGERS. Poor lady! Who will tell her?

HANS. I fear it will be a great shock to her. But here, who comes forth from yonder house?

VILLAGERS. 'Tis Father Lucas.

FATHER L. (*coming out of his house*). My people, what is it that causes you to assemble here at this time of day? Methinks naught but news of the crusaders should excite you so. Come, tell me.

ROBERT. Aye, father, it is news of the crusaders which stirs us so. O father, father, they have all perished!

FATHER L. Speak not so unless you are sure of it. What idle gossip has started this evil news?

MARGARET. O father, it is too true. The merchant ——

FATHER L. The merchant, daughter? Why didst thou not tell me of him at first? Where is he?

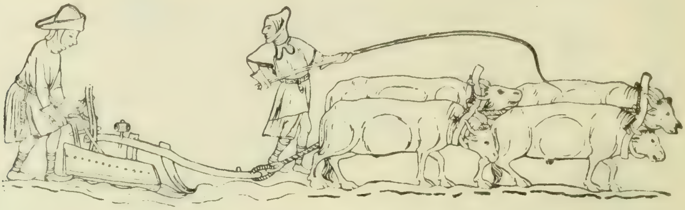

FIG. 124.— *Plowing in the Middle Ages*

GURTH. Here, father.

FATHER L. (*to Hans*). Merchant, are you sure of this?

HANS. Aye, most reverend sir. I am come direct from Ghent. Messengers met me and told me that King Richard and all his followers had perished.

Enter Brother Malvoisin

BROTHER M. What is the trouble? Didst thou say the crusaders will not return?

FATHER L. The merchant from Ghent brought the report.

BROTHER M. But, brother, thou knowest how easily these reports are started and how often untrue. Hark, ye people, this may not be so; many times these reports are not true. Let us hope for the best, and let us be prepared for our crusaders' return.

FATHER L. My poor people! Oh, for their sakes I pray it is not true!

BROTHER M. Dear people, be not disturbed; it is probably not true.

MARGARET. Has any one gone to the manor house? Oh, think of the poor lady in this time of sorrow — she, with her husband and only son lost, if this report be true! Let us try to help her in her grief. We feel that we have lost our all, but we still have our children with us. Our dear Lady Beauchamp has lost her only son.

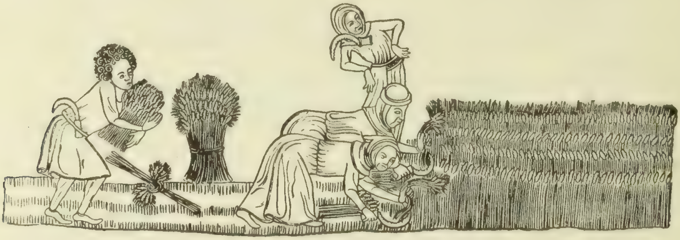

FIG. 125.— *Reaping in the Middle Ages*

(*Exit people; women sobbing, men talking. Father Lucas and Brother Malvoisin decide to go to the manor house and take Hans with them.*)

FATHER L. Come, merchant, to the Lady Beauchamp, and tell your tale.

(*Exeunt all.*)

CURTAIN

Scene 2

SCENE.—*Manor house hall. Lady Beauchamp, Rowena, and Eleanor. Lady Beauchamp sitting apart when knock is heard.*

LADY B. Enter.

Enter Father Lucas, followed by Brother Malvoisin and Hans Sesamman

LADY B. (*rising and addressing Father Lucas*). Father, it is a great pleasure to see you. Have you any news by chance?

FATHER L. My daughter, we bring but sorrowful tidings. Prepare yourself for the worst.

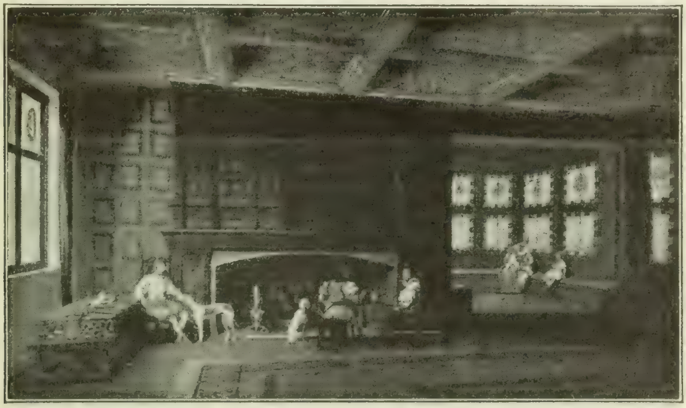

FIG. 126.—*Great hall in Elizabethan manor*

LADY B. Father, I have felt all day that something was to happen before sundown. I pray you, tell me at once. Do not keep me in suspense. Is my precious husband injured? Have they taken Jerusalem? Tell me, is my boy dead?

ROWENA. Holy father, tell us, I pray you. Is our father or brother harmed in any way?

BROTHER M. (*struck by Rowena's gracious presence*). Mesdames, pardon, and be calm. Our dear brother will tell us.

FATHER L. Aye, my lady, it is sad, sad news, yet a story that shall make your heart rejoice. When you hear, you cannot mourn.

LADY B. Hold! Hold! What do you mean? (*Sinking into a chair.*) You can hardly mean that — that they are — oh, it cannot be!

HANS. Aye, lady. You have a husband and a son to be proud of. They stood firm to the last.

ROWENA (*to the merchant*). O good sir, tell us what reports you have heard. Do not keep us in suspense. Tell us, we beg you.

HANS. I have told all. In passing over the country I met messengers who told me that Richard Cœur de Lion had suffered total loss and he himself was a prisoner.

FATHER L. (*as Lady Beachamp begins to sob*). My daughter, the report is doubtless false. If it is true, then must we remember that it was so writ in Heaven. But be of good cheer; lose no hope. Our dear Lord Beauchamp has gone for a noble cause.

ELEANOR (*to merchant*). O sir, tell us if this can be true. Will our dear ones never return?

LADY B. (*shaken, but calm*). My daughter, hush! Listen to what the merchant has to say.

HANS. Ladies, this may be untrue, as you say, but the messengers were in great haste and alarm and said that they had come over the desert from Jerusalem. I doubt if it can be false. It does not look so.

BROTHER M. Friends, if this be true or false, then should we not think of the people in the village in this time of suspense? "Comfort ye my people," saith the Lord.

LADY B. Yes, we must not think of ourselves alone. How can I help the poor villeins while they await more certain news? Ah, I will give them a festive evening here at the manor house. It will for a time turn their thoughts from their sorrows.

FATHER L. Surely the blessings from on High will fall on such as you, for you comfort others in your sorrow. God be with you!

(*Exeunt Father Lucas, Brother Malvoisin, and Hans.*)

CURTAIN

ACT II

SCENE.—*In manor house hall. Lady Beauchamp, ladies, and others. Guests arriving dressed for holiday occasion.*

LADY B. I bid ye all welcome hither, good friends. Take off your cloaks, and sit by the warm fireplace.

GURTH. We thank you, lady, for this festive night. It is good of you to think of us in your sorrow. It eases ours.

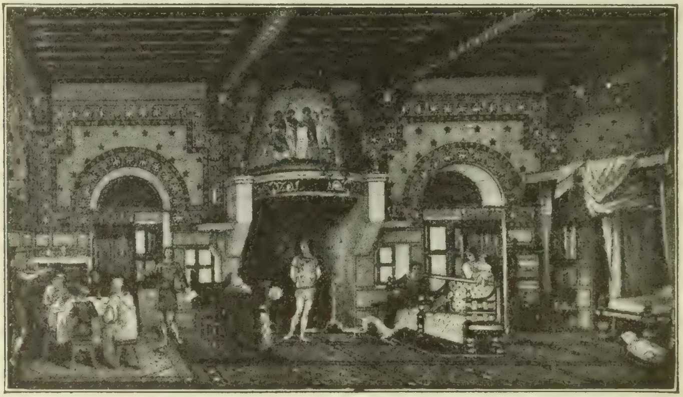

FIG. 127.— *Great hall of a castle in the late Middle Ages*

LADY B. We must all be of good cheer. Welcome, good Margaret! How is your aged mother?

MARGARET. Quite well, my lady, thank you.

LADY B. I am glad to hear that.

FATHER L. Good lady, you are very appreciative of the misfortunes of the villeins' wives. 'Tis good of you to try to cheer them.

BROTHER M. Let us rejoice and not feel unhappy, as it will only make matters harder. Rumors often prove false. (*To Father Lucas.*) There are Lady Beauchamp's daughters. I will speak with them.

MARGARET (*to Jessica*). Is not this a beautiful manor?

JESSICA. I trow, there ne'er could be an equal.

LADY B. (*to Brother Malvoisin*). I am very much afraid that what the merchant told us will prove true, but I must not give way to my feelings. Others have sorrows also; I at least have my daughters.

(*Meanwhile Brother Malvoisin and Lady Beauchamp's daughters converse in French.*)

BROTHER M. Courage! Courage!

ELEANOR. Oui, mon père. (Yes, father.)

ROWENA. Nous ne pouvons rien faire qu'espérer et prier. (We can do nothing but hope and pray.)

FATHER L. (*to Lady Beauchamp*). My daughter, you should be very thankful that both your daughters are with you, and also that you have this beautiful home, with everything in it that could help one in time of trouble.

Lady B. Holy father, very thankful am I for my daughters and my blessings. Still, I have a premonition that either my husband or my son will not return. And, as I am but a woman, and have a woman's heart, I must weep. Good father, have you brought the merchant with you?

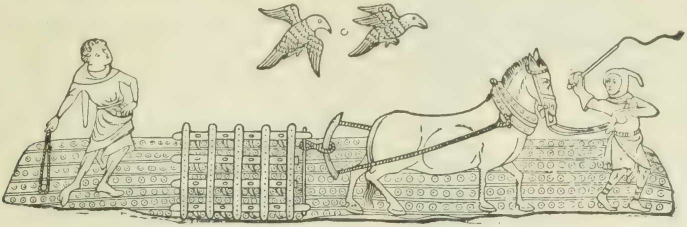

Fig. 128.— *Harrowing in the Middle Ages*

Father L. Yea, my daughter. Yonder is he, telling tales to the youths and women. Let us draw near and listen to his stories.

(*They go to the merchant, about whom a large crowd has gathered.*)

Hans. As I told you, many merchants had for a long time felt the need of protection and regulation, so we have formed guilds and leagues to help each other.

A Youth. How do they help you? What are they like?

Hans. Well, there are two kinds of guilds, craft guilds and merchant guilds. To the craft guilds belong the artisans, such as bakers, spinners, weavers, and so forth; while to the merchant guilds belong all the traders of each town. You see, young lad, that many times when we send our goods by land or sea we are subject to dangers from robbers on land and pirates by sea. Many a time have I had to pay an unreasonable toll on my goods. So, in order to make our trading easier, we have established trading posts at different cities.

A Youth (*eagerly*). Sir! O sir! Do they let young men enter the league?

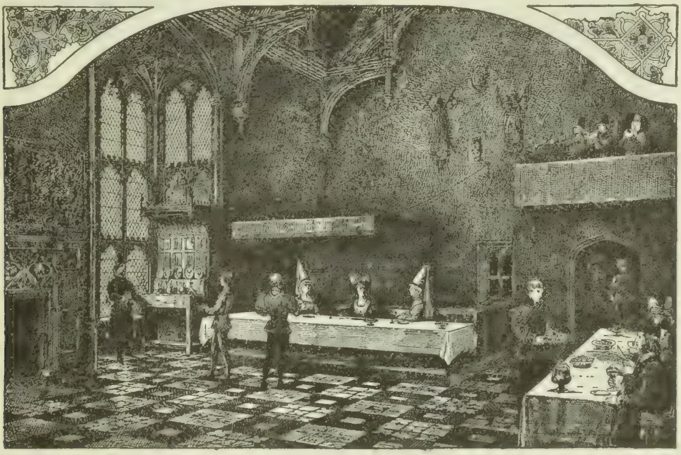

Fig. 129.— *Dinner at the home of a noble lady in England in the fifteenth century*

Hans. No, my lad, *boys* (*with emphasis on boys*) do not enter unless they are apprentices to a member of the guild.

Some Boys. Apprentices? What do you mean ?

Hans. Why, this, boy. If you wanted to become a tanner, your parents would sign an agreement made in writing that you were to live with a certain tanner a certain number of years. During your sojourn with him, the tanner would supply you with clothes and all things that were necessary to you. Then ——

YOUTH (*to another lad*). O Joshua, would it not be much better to be apprenticed to a tanner, than to work in the fields?

OTHER BOY. Aye, much better. But look! The warder has entered.

JONATHAN (*to Lady Beauchamp*). My mistress, supper is prepared.

LADY B. (*to guests*). I bid you all welcome to the feast.

(*Lady B. claps her hands; stewards enter with table and utensils and prepare the feast. The villeins sit down to the feast. Their manners are rough and uncouth.*)

GURTH (*to Robert*). In sooth, this holiday is most welcome. I, for one, am glad of it.

ROBERT. And I also. I have worked hard in the fields of late, for I have tried to plow Mistress Longwood's lot for her since her husband went away. Poor soul! But she bears herself bravely.

WILLIAM. List to the merchant and monk who are talking!

BROTHER M. Yea, I have seen many beautiful buildings in my journeyings.

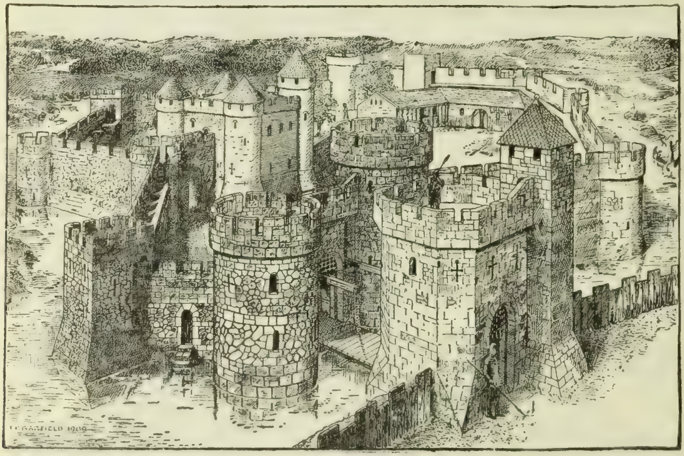

FIG. 130.— *A Norman castle*

HANS. Ah, no country can have such beautiful cities as those of the Low Countries. Some of the most magnificent cathedrals and castles are being built there as in England. The cathedrals have those most wonderful pointed arches, and slender spires. All are richly ornamented. The windows are of stained glass and on them are painted holy pictures. And all these cathedrals are so large that they inspire you with awe as you gaze upon them.

A VILLEIN. Is't possible that these things are true? (*To persons beside him*). I am much given to thinking that the merchant is telling false tales.

SECOND VILLEIN (*whispers reply*). Aye, but the monk did say that he saw these wonders. Surely what a monk says is true.

BROTHER M. I beheld many beautiful castles; always were they built on rock fortresses, and always with a moat around them.

A VILLEIN. A moat! What is a moat?

BROTHER M. A moat is a large ditch which is filled with water. This ditch is dug around all sides of the castle. You have many of them in England, but you have never traveled far from this spot, methinks.

A VILLEIN. What is its use, good sir?

BROTHER M. It is used to protect the castle. If hostile people should wish to get into the castle, they would have to cross the moat first, and this is ofttimes impossible.

HANS. One castle I saw that impressed me much. It had a donjon.
VILLEINS. What is that?
HANS. A donjon, or large square tower, was surrounded by buildings of inferior height which were encircled by an inner courtyard. Around the exterior wall was a deep moat supplied with water from a neighboring rivulet. The way to this castle

The castle is situated on the summit of a rocky precipice

- W. A winding road, the only means of access
- A. Open space where the lord's retainers formed before a march, and from which the road was guarded
- B. Bridge leading into the castle exterior
- C. Towers for outlook and defense
- D. Screen for protection against besiegers' missiles
- E. Servants' quarters and stables: in time of siege these were usually fired and abandoned
- J. Exterior court
- G. Moat
- F. Drawbridge
- H. Interior court
- K. First entrance way
- M. Inner entrance
- P. Castle proper
- RS. Dungeon keep
- T. Interior wall: the towers surrounding the inner courts had a hidden connection formed by T

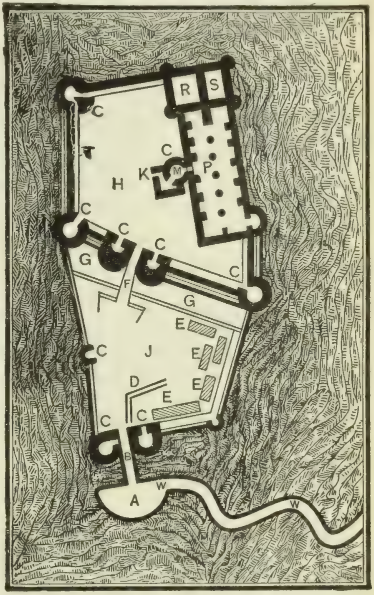

FIG. 131.— *Plan of a medieval castle*

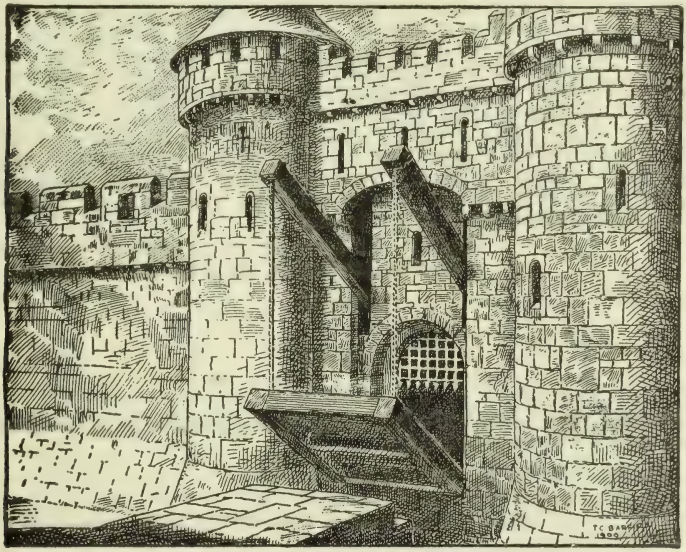

FIG. 132.— *Drawbridge and portcullis for defense in the Middle Ages*

lay through an arched outwork, which was defended by a small turret at each corner. There was one room that made me shiver when I saw it. But I shall not tell of its horrors; they are not suited to such a gay company. Also, I saw some beautiful rooms occupied by the lord and lady of the castle. In sooth, I never have seen a more beautiful structure than that one, and I have seen many.

(*The villeins have gained by this time a spirit of gayety and have talked among themselves quite merrily as they ate. Now they arise and take leave of Lady Beauchamp.*)

MARGARET. Good even to you, my lady. May the All Merciful bring back your lost loved ones!

LADY B. I thank you, good Margaret. May it be the same with you!

JESSICA. My lady, my best wishes go forth to you. Good even!

LADY B. We all feel for one another in our time of need. I hope that all this shadow will turn to joy.

A VILLEIN. Right thankful are we to you, lady, for the pleasant evening we have spent. We all do give you the best of cheer.

LADY B. I thank you, my people. Fare you well! Be you not afraid to come to me with your grievances. I will willingly help you all.

VILLEINS. We thank you, lady. (*Exeunt villeins.*)

FATHER L. God be with you, daughter, until your husband and son return unto you. If they do not, then 'tis His will that it should be so.

BROTHER M. Bon soir, mesdames. (Good night, ladies.)

LADY B. I will be of good cheer. I thank you both for your aid and comfort.

ROWENA. I also join my mother in her thanks.

ELEANOR. And I also.

FATHER L. God be with you!

(*Exit Father Lucas, Brother Malvoisin, and Hans.*)

LADY B. (*to daughters*). And now, my daughters, you must straightway go to your room. Rest and sleep peacefully until morning, that you may awaken with new strength to encounter the pleasures and sorrows of the forthcoming day.

DAUGHTERS. Good night, dear mother.

(*Exit daughters. Lady Beauchamp, alone, walks up and down the floor, wringing her hands and crying.*)

LADY B. Oh, why did my husband and only son go on that crusade? It cannot be true, it cannot. Why could not they be content to stay at home with me? I tried to persuade them not to go, but they would say, " 'Tis the will of God! 'Tis the will of God! The Lord calls us to rescue the Holy Sepulchre; wilt thou have us stay at home?" But two men less would not have made any difference — No! That is not fair to the other women. I must think of the villeins, as the priest bids me. I know that either my husband or son will not return. (*Here she folds her hands and looks toward Heaven.*) O dear Father! watch over them, keep them from harm, and bring them back safe to me. How have I ever sinned that this great sorrow should come upon me? What shall I do without them? I must calm myself and bear their sorrows. The poor villeins' wives! What will become of their children? Mine will be well cared for, but theirs, poor things! I know nothing about the keeping of this manor. Oh, if only either of them would return to me!

(*Lady B. sits down and weeps softly to herself so as not to awaken her sleeping daughters in the next room.*)

CURTAIN

ACT III

Scene 1

SCENE.—*Inside Godfrey Longwood's hut; Margaret Longwood with her children, who are playing about; also the grandmother.*

ADAM. Let us play that we are on a crusade, Seth.

SETH. Oh, yes, and I will be King Richard ——

ADAM. No, no! I must be King Richard the Lion-hearted. I am the eldest and you can be ——

SETH (*sulkily*). If I can't be King Richard, I am not going to be anybody.

ROSALIND. May I play? I will be father and I'll come home and ——

ADAM. All right! Now, my merry men, all together for the crusade.

CHILDREN (*all talking at once*). Let us get —— The chair for my —— I tell you I must have more —— Come on, now, start for the crusade ——

MARGARET. Children, can ye not be more quiet? Ye are all more noisy than ye are usually wont to be.

ROSALIND. Mother, why does not father come home?

(*Mother sighs heavily.*)

ADAM. Dear mother, why dost thou sigh so wearily? I am almost sure that father will come back. Brother Malvoisin says there must be a mistake; not all the men could have been killed. Surely the good Lord spared some, and father must be one of these.

SETH (*excitedly*). Last night I dreamed that father had come back to us, and I told Father Lucas of it, and he did say that it must be a sign from the Master that father would yet come home.

MARGARET (*doubtfully*). I hope it may prove so, my little ones, for it is but a sorry household without the good father. Grandmother, too, did see him in a dream last night. Well, in sooth, I am beginning to think that father will yet return. (*A knock at the door.*) Somebody knocks at our door; go, little Rosalind, and let the person in.

ROSALIND (*pressing against the door*). O, mother, I fear me!

ADAM. It is a crusader, mother; mayhap he hath news of father. (*Throws open the door.*)

Enter Godfrey, lugging a large bundle. Margaret and the children stand stone-still, not recognizing the man

GODFREY (*amazed*). What! Dost thou not know me, Margaret? Children, I am your father! Little Rosalind, hast thou no greeting for me? Is it possible that ye have all forgot me?

ADAM. Nay, good crusader, you are not our father. He was not so spare and thin as you are; your cheeks are a swarthy brown and his were not so dark; and you have a beard, which my father had not.

GODFREY. Mother will know me, I am sure. (*Shouts at Grandmother.*) Mother, dost thou not know me, Godfrey, thy youngest son?

GRANDMOTHER. Eh? What sayest thou? I am somewhat deaf.

MARGARET. In sooth, I think you are somewhat of my late husband's build, and yet you are not the same.

SETH (*whispers to mother as Godfrey makes a familiar gesture*). Mother, I did see the stranger throw up his head as father used to do.

ADAM. You are strangely like my father, yet you cannot be he, for all of King Richard's men were killed and he did follow King Richard.

GODFREY. I am thy father, boy; I was never dead; of King Richard's men but a few were killed. Yet, among these was Lord Beauchamp and a squire.

MARGARET. Ah, the voice is truly like my husband's. Can it be he? (*Hesitates.*) It is, it is — yet it cannot be — and still —— (*She recognizes Godfrey.*) Children, father has come home!

CHILDREN (*in confusion*). O, father, what is in the —— Why art thou so much thinner than —— Last night I dreamed that thou camest home, father, and ——

GODFREY. So I have, my lad, and never more will I leave thee.

CURTAIN

Scene 2

SCENE.—*The same. Neighbors, hearing excitement, press in.*

GURTH. Good Mistress Longwood, we have heard noise within thy house; hast heard aught of our crusaders? (*He catches sight of Godfrey.*) Why, who art thou, sir? (*To Robert.*) Doth he not mind you of one we know?

ROBERT. Aye, so he doth. Surely he looks somewhat as did Neighbor Longwood.

GURTH. I verily believe that 'tis he. I am almost sure. (*To Godfrey.*) Why, man, art thou risen from the dead?

VILLEINS. Who is it?

GODFREY. Do ye not know me? I am your neighbor, Godfrey Longwood.

ROBERT. Wert thou not slain with all of King Richard's men?

GODFREY. No, no, good neighbors, I have never been killed or dead. Of King Richard's host but a few were slain, and ——

EDITH. Oh, good Master Longwood, canst tell me aught of my husband? 'Tis three long years since he did go away and ne'er a word have I heard of him. Is he alive and well? Is he on his way home?

JESSICA. What of my husband? Was he slain? (*Godfrey hesitates.*) Alas, my heart forebodes evil tidings! Tell me, is my husband ever to return to me?

A WOMAN. What of Lord Beauchamp and his son? Our lady had news that both were slain.

FIRST VILLEIN. In sooth, the merchant told her that all King Richard's men were slain.

GODFREY. Good Mistress Dale, thy husband is dead. Both he and Cedric Villiers died during the awful siege of Acre. We lost but a few of the army there, mayhap a score or so. Yea, both our friends are laid to rest.

SECOND VILLEIN. What of Lord Beauchamp?

VILLEINS. Tell us of him and his son.

GODFREY. When ye will let me, I will speak. I will gladly tell all that I know.

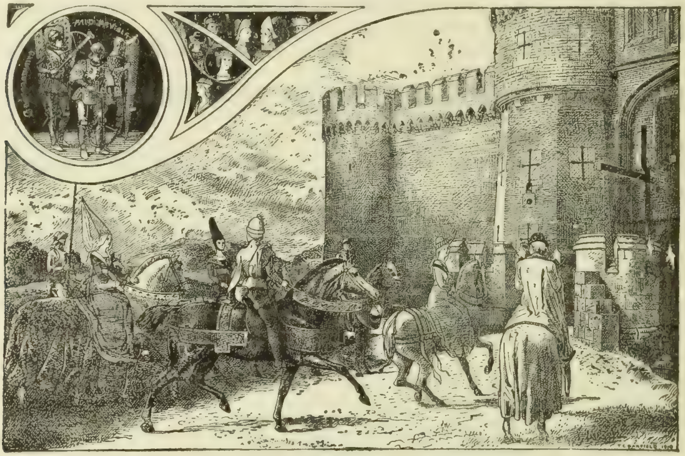

FIG. 133.— *At the gate of the castle*

The road was rough, and hard indeed was it for us to travel. The men on horses had ofttimes to dismount and help the weary creatures drag themselves along the hot and dusty roads. Many died on the way, but Lord Beauchamp journeyed on without resting. One day, during the siege of Acre, I saw his eyes heavy and his cheeks flushed with the fever. He had been taken ill. It came from the heat, hunger, and thirst that lord and villein alike had to endure.

FIRST VILLEIN. Did Wolfred also take the sickness?

GODFREY. No, Wolfred rode by his father's side always. Always Lord Beauchamp was brave. Not a murmur escaped his lips, though he suffered terribly. Still did he ride on and on. Soon we were told that we were nearing the Holy City. Ah, can I ever forget that awful march! Lord Beauchamp was just able to mount his steed. We were all eager enough to march on when we heard the cry, "On to the Holy City! Jerusalem! Save the Holy Sepulchre from the infidels!" The cry seemed to rouse us and give us new life and energy to travel onward. When we reached the Holy City, a hidden infidel force sprang upon us and a battle raged. Ah, many were killed! The French forces suffered most, for they led the march. After the battle ceased, I looked about me to see what had come to pass, for I had been stunned by a well-aimed blow.

ROSALIND. Poor father, did it not hurt thee?

GODFREY. Ah, my child, many men had blows given them that hurt much more than mine. And many Christians were slain; I bent nearer to look upon the slain, and lo, Lord Beauchamp lay among the dying. I bent close to him and he whispered, "Commend me to my lady and children. Tell Wolfred that I give him my blessing, and ——" (*A short silence.*) And so he died. Beside him lay one of his squires. Alas it grieves me sore to tell such a tale! (*The women are weeping and the children are gazing at them in wonder.*) Wolfred I saw later, sitting silently, bowed with grief. He has returned and with him came Mares, his squire. He is now probably in the castle with his mother and sisters. And now ——

William. Tell us of Jerusalem!

Godfrey. Aye, friends, I will tell ye.

Robert. Hush, all! Neighbor Godfrey will tell us of the crusade.

Godfrey. My friends, ye cannot realize the hunger, sickness, and other hardships that we had to endure in the camps in the Holy City. On the second day, another battle raged. We saw the spot where Solomon's temple once stood. Here the men rode up to their horses' knees in the blood of slaughtered infidels.

(*A youth, after making many queer antics during the story, is trying to use a trumpet.*)

Youth (*to Godfrey*). I beseech you, good sir, tell me what this queer thing may be.

Godfrey. This is a trumpet that sounds very well when it is played. (*Blows a blast on the trumpet.*) That (*pointing to drum*) is a drum. (*Beats drum. People cover their ears in fright.*) But to go on with my story. For many days following the battle careful watch was kept, for the hostility of the infidels was carried to the uttermost. After many months had passed, some of us started on our homeward march. When I was coming home I saw many beautiful tapestries and rugs of wonderful coloring. I have brought home silks, spices, and various articles.

(*Some of the boys are trying to use the drum and at last one of them accidently hits it. The noise becomes worse and worse; some one blows the trumpet; others beat the drum; the children are all talking at once. The grandmother has all this time been handling a piece of silk which the children have brought to her.*)

Grandmother. My son, what is this soft thing? Where didst thou get it?

Godfrey (*shouting above noise*). Mother, that is silk; I got it from an infidel. These spices that I brought home — (*goes to take some and finds children are tasting them*) are used by the people of the East to flavor their food with. They taste very good. A queer thing which I saw in the Holy Land was ——

Enter Father Lucas. Everything becomes quiet. Father Lucas greets Godfrey and gives him his blessing

A Woman. Father, have you been with Lady Beauchamp? Is her son with her? How bears she her trouble?

Father L. Lady Beauchamp is trying her best to hide her terrible grief at the loss of her husband. When I left her, she was listening to her son's story of the crusade. (*Goes over to the widows who stand apart from the rest, silently weeping.*) Be comforted, my daughters. Although your lot is very hard to bear, and your husbands cannot return to you, remember that they have passed to a place of eternal happiness. Such is the reward of those who labor for the Holy Cause. Take heart and rejoice, for your husbands have entered the Kingdom of God.

The End

I am sure you feel, from this one reading of the play, that it would interest others as well as it has interested you, and that it would be fun to dress up so as to represent these characters and to act out the suggested scenes. You can have your leader explain to the audience before the curtain rises, or in the local newspaper, that the principal characters are typical of the time and place, and that the details of a general nature — such as the news of the crusade movement itself, and the surprise and delight of the people over new objects such as drums, spices, silk, and trumpets, that the crusaders have brought back — are based on historical facts. The individuals who will walk before them in the play with their queer-looking clothes and implements, their strange words and ways, their joys and sorrows, will be, after all, very human, very likable, very interesting to every American farm girl and boy and to their parents and friends.

In order to understand your lines and characters better, it would be well to take from your library and read aloud at some of your meetings such a book as "Outlines of English Industrial History," by W. Cunningham,[1] which devotes Chapter III to *The Manors;* or Chapter II, on *Rural Life and Organization*, in Cheney's "Industrial and Social History of England;"[2] or, better still, Chapter I, on the *Manor and Village Community*, in Ashley's "Economic History."[3] The prices, as well as the publishers of these books are given in the footnotes, so that if the book is not in your library you may put in an application for it; or if each member of your club would give a nickel or a dime, you could buy one book on the manor and one on the crusades. The traveling library issued by the University of New York, at Albany, may supply these books to you.

For facts about the crusaders, you can read aloud in turn Archer and Kingsford's "The Crusades"[4] and Cox's "The Crusades."[5]

For pictures of the costumes and implements that you might make for staging the play successfully, there is one authority especially good — that is, Razinet. The book is out of print now, and rare, so that I doubt whether it will be found in any library outside of cities and universities. I have the hope of providing you with a separate leaflet for circulation by September, which will show in color or in black and white such pictures as you most need.[6]

If the older girls and boys in your community, on consultation with your leader, feel that this play is too ambitious for your very first attempt, then try an easier one first — as your mother bakes a small round cake to try both batter and oven. Choose, early in September, eleven girls and boys ten to twelve years of age, and drill them for a Thanksgiving Day celebration to be held by your grange or at some church entertainment in November. You can make their costumes, get the stage properties, prepare the big wall map, and then drill these children so that they can give the play well enough to justify your inviting "grown-ups" and charging an admission fee. The following play has already held the attention of many an audience from start to finish.

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[1] Outlines of English Industrial History. By W. Cunningham. The Macmillan Company. $1.50.

[2] Industrial and Social History of England. By Edward P. Cheney. The Macmillan Company. $1.40.

[3] Introduction to English Economic History and Theory. By William J. Ashley. Longmans, Green & Co.

[4] The Crusades. By Archer and Kingsford. G. P. Putnam's Sons. $1.50.

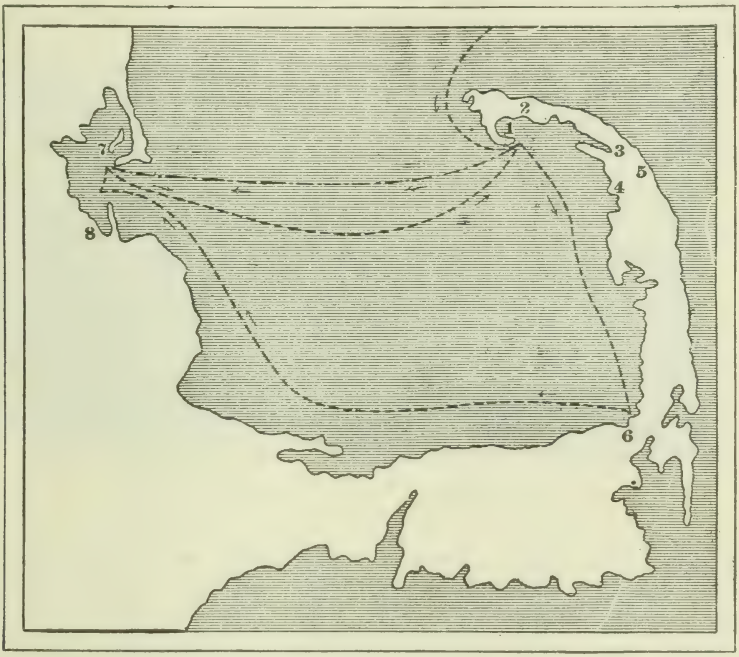
[5] The Crusades. By G. W. Cox. Longmans, Green & Co. $1.

[6] For a single book to help you on pictures and text and to explain them to you in this stage setting, I should advise Howe's "Essentials in Early European History," from which several illustrations in this pamphlet have been reproduced by permission. The book is written by Samuel B. Howe and published by Longmans, Green & Co., New York.

AFTER-DINNER STORIES AT THE FIRST THANKSGIVING TABLE [7]

DIRECTIONS

Make an enlarged reproduction of the map (Fig. 134) on a blackboard or a stiff white board, or even on brown paper, and put it in plain sight of the audience so that a clear conception of the route and landing-places of the Pilgrims can be gained. By using a low table set with old pewter dishes on a snowy damask cloth as the center of the group of five girls and six boys — all dressed in Pilgrim costume (See Fig. 135) — the scene will seem doubly real as the boys tell their stories. In the choice of boys for the parts, a short, thickset lad should be chosen to represent Myles Standish, and one who is particularly shy and bashful to represent John Alden.



KEY: 1. First anchorage of the Mayflower; 2. Spot where John Alden's party spent the night; 3. Spring of "New England water"; 4. Corn and kettle found; 5. Two houses found; 6. First encounter with Indians; 7. Clark's island; 8. Plymouth; — · — - — · —. Course of the Mayflower; — — — —. Course of the shallops

FIG. 134.— *Map of Cape Cod and Massachusetts Bay*

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[7] This play is reprinted from "Indians and Pioneers." By Blanche Evans Hazard and S. T. Dutton. Silver, Burdette & Co.

THE TEXT[8]

Introduction by Governor William Bradford

You ask us for a round of stories, and ask me to begin, and, because a governor must be a servant of his people, I comply. You shall have your stories; they will be like our Pilgrim lives, I fear, full of sorrow, yet full of hopes and of brave deeds. Those days which we spent in the shallop exploring Massachusetts Bay had many adventures which we have never taken time to recount.

You recall that November day when we came to anchor off Cape Cod? We were full of joy at finding ourselves near land, even if we were far from the Hudson, where we had hoped to land, and even if there were no friends nor homes to welcome and cheer us.

As soon as we had fairly anchored, some fifteen of us waded to the shore, at about a bowshot's distance, to fetch some wood and to spy out the land. The sand hills reminded us of the downs in Holland. We found oak, pine, and birch trees, and gathered our wood easily for it was plentiful.

Captain Gosnold, Captain Henry Hudson, and Captain John Smith had told the English people about this cape. From their accounts and by what we saw that afternoon, we realized that it would never do to plant our colony off this bleak, sandy point. We decided to explore the bay for a spot where a brook and fertile land made some promise of a good location. It was decided, also, that this exploring must be done by a few of our men in the small boat which we had brought over in the *Mayflower* stowed away between decks. This shallop could sail along shore in shallow water, and up into the creeks. Meanwhile, you women and children were to stay there in the *Mayflower*, to do what you pleased, and enjoy yourselves the best you could.

FROM PAINTING BY BAYES

FIG. 135.—*Pilgrims watching the departure of the Mayflower for England*

Nay, pray, Mistress Priscilla, do you blush when I speak of our leaving John Alden and the other younger men there in the *Mayflower*, while Captain Myles Standish led the others? No doubt John would have gone with us in the shallop if his years and gray hairs had been more in number. He did go on the excursion on Cape Cod, made while the carpenters were repairing the shallop. John, tell us the story of that adventure.

John Alden's story

We started on the fifteenth day of November. Captain Myles Standish ordered our company of sixteen men to march in single file. Each man carried musket and sword. First we followed the shore until we spied five people and a dog coming toward us. These savages turned almost immediately and ran away with might and main into the woods, whistling their dog after them. We followed the trace of their footsteps for over ten miles that afternoon. At night we set up the sentinels, kindled a fire, and settled ourselves for the night. I cannot tell you all about that excursion. We marched day after day "through boughs and bushes, and under hills and through valleys — tore our very armor to pieces," but could neither meet any Indians nor find their homes or fresh water for ourselves. Our victuals were dry biscuit and Holland cheese. Once we followed a deer to a spring of fresh water. "Then we were heartily glad, and sat us down and drunk our first New England water with as much delight as ever we drunk in all our lives." This was the beginning cf good fortune for us. Soon we came upon a "plain ground" with "some signs where the Indians had formerly planted their corn." We found walnut trees full of nuts. Then, best of all, a field where there were traces of a house and a big black kettle evidently some European ship's kettle. In a heap of sand near by we found a "little old basket full of very fair corn of that very autumn's harvest, yellow, red, and blue ears, making three or four bushels in all.

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[8] This text has been adapted from such original sources as Young's "Chronicles" and Bradford's "History of Plymouth Plantation." The endeavor has been to keep the spirit, even when the original quaint wording had to be dropped for the sake of clearness in meaning.

"We held a consultation, and concluded to take the kettle and as much of the corn as we could carry away with us; and that if we could find any people when our shallop came along that way, to give them the kettle and parley with them for the corn. We took all the ears, and put a good deal of loose corn in the kettle for the men to bring away on a staff."

FROM PAINTING BY W. F. HALSALL, IN PILGRIM HALL, PLYMOUTH, MASSACHUSETTS

Fig. 136.— *The Mayflower and the shallop*

"And thus, as you know, we came both weary and welcome home, and delivered our corn into the common store, to be kept for the seed." That was the seed we planted this spring and harvested this autumn. Perhaps I might confess that one ear of red corn I gave to Priscilla Mullins, and that Mistress Priscilla Alden has it now.

Stephen Hopkins's story

Governor Bradford says that I am to tell you the story of our cruise in Massachusetts Bay, so I begin my story without making "much ado about nothing."

When we returned from our Cape Cod excursion, we found the shallop nearly ready. On November 27 we set out, with Master Jones as our leader. We men felt that he had treated us fairly, even if the women felt he had played us a mean trick in landing us far from the Hudson River.

"It proved we were to battle with rough weather and cross winds. Several of us left the shallop — marched along the shore in a heavy snowstorm. Some of the people that are dead took the original of their death there."

The next day our parties found each other, and that night Master Jones, wearied with marching, urged us to make "our rendezvous under a few pine trees. As it fell out, we got three fat geese and six ducks to our supper, which we ate with soldiers' stomachs, for we had eaten little all that day."

When morning came we found this spot would not be suitable for a settlement, so explored more creeks, went to the cornfield we had rifled before, found the rest of the corn, but no people. Of this we were not wholly sorry. We found a bag of beans and a bottle of oil.

We sent Master Jones home with the weaker members of our company, and sent our corn by them. Then we ranged and searched until we found bowls, trays, dishes, fair new mats, and a great quantity of red powder. Finally, we found two houses left without occupants.

That next night the shallop joined us, and our reunited company discussed the still unsettled question of where we were to make our settlement. Some of us were in favor of this spot; others, not satisfied with the place, wished to make further discovery within the bay.

It was now December. On the sixth day we set out once more from the *Mayflower* — Captain Standish, Master Carver, Governor Bradford, Edward Winslow, and fourteen others.

Myles Standish was leader, and can tell you the story of our first encounter with the Indians.

Captain Myles Standish's story

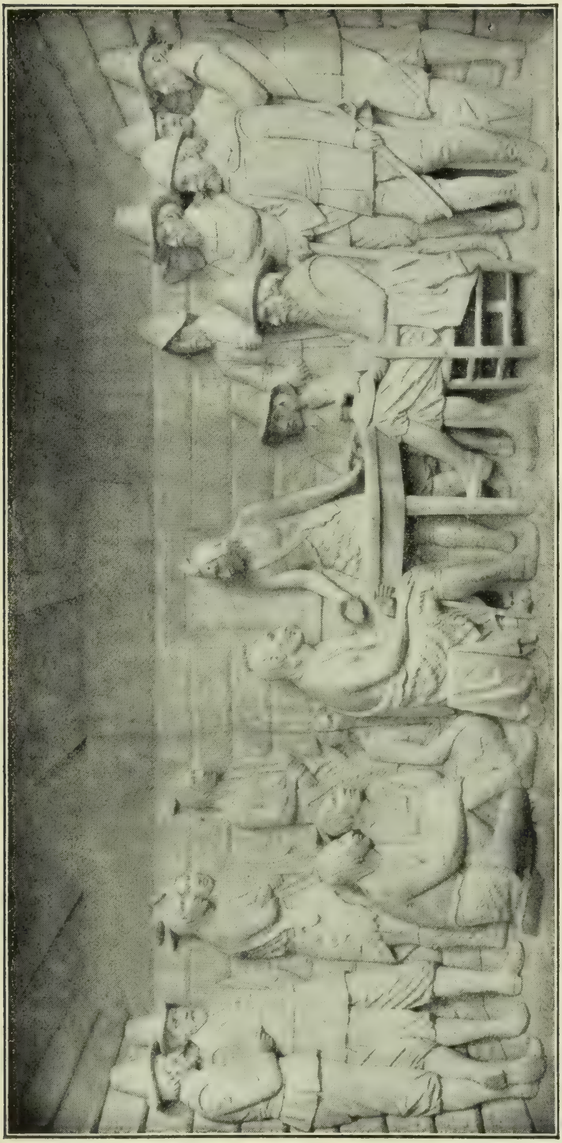
Master Stephen Hopkins asks me to tell the story of the first encounter. Must I, good friends, speak for myself? Young John Alden has once again spoken before me, but not for me. Again, I perceive I must speak for myself. Briefly, though, I warn ye, for I am a man of few words. My gun serves me better than my tongue.

After beating about the bay for a day and a half, some of us landed, and went ranging up and down until the sun began to draw low and the sixth day of December was nearly done. Then we went toward the shore, thinking to go aboard the shallop once more. We spied it a great way off, and called to the sailors. They came as soon as they could, rejoicing to see us emerge from the woody shore again. "We were weary and faint, for we had eaten nothing all that day." We got some firewood and supper, then settled for our night's rest, setting our watch as usual. "About midnight we heard a great, hideous cry, and our sentinels called, 'Arm! Arm!' So we bestirred ourselves, shot off a couple of muskets, and the noise ceased. We concluded that it was a company of wolves or foxes."

The next morning, while we were at breakfast, "we heard a great and strange cry which we knew to be the same voices, though they varied their note. One of our company, who was on the lookout, came running in, and cried, 'They are men! Indians! Indians!' and just then their arrows came flying amongst us." Our men ran with all their speed to get their arms, for before breakfast they had taken them, with other luggage, down to the shore, ready to be put on board the shallop. Fortunately, they got them and put them to good use. In the meantime, having a flintlock musket, I made a shot. I "urged the men not to fire at random, for we had little shot to spare. We feared for the men in the shallop, and called to know how it was with them. They answered, 'Well! Well!' and 'Be of good courage!'" Our men were no sooner ready than the enemy began to assault them. "There was a lusty man who was thought to be their captain. He stood behind a tree, within half a musket shot of us, and from there let his arrows fly at us. He was seen to shoot three arrows," which we dodged. "At length, one of our men took full aim at him, after which he gave an extraordinary cry, and away they all went." How many there had been we could not tell, for it was "in the dark of the morning"; some said forty, and some said more. So after we had given thanks to God for our deliverance, we took our shallop and went on our journey. This place we called the First Encounter. Now ask Mate Clarke to tell you about his island.

Mate John Clarke's story

I prithee, Captain Myles Standish, do not leave me alone to plunge into that cold salt spray again, to feel the ice freeze my garments stiff while I search in the storm for a resting-place for my weary, half-frozen comrades. Must I go on with the tale, Governor Bradford? Yea? Since you and Captain Standish both give order, I can do naught but obey. Have courage, friends, my sad adventures will end in a peaceful Sabbath.



FROM A BAS-RELIEF ON FOREFATHERS' MONUMENT, PLYMOUTH, MASSACHUSETTS

FIG. 137.— *The treaty with Massasoit. Massasoit is seated at the table; Squanto is acting as interpreter; Myles Standish, sword in hand, stands at the right*

We had sailed for some hours on the afternoon of December 8, when it began to snow and rain. "The seas began to be very rough," the hinges of the rudder broke, so that we could steer no longer with it. Two men with much ado were obliged to steer with a couple of oars. Then our mast broke in three pieces, and the sail fell overboard. The tide however, was with us, and our men rowed lustily. Just after darkness came down "we made for an island before us, reaching it safely, though it was encompassed by many rocks." We fell upon a piece of sandy ground, where our shallop did ride safe and secure all that night. Not knowing we were on an uninhabited island, fearing Indians, some of us wanted to keep in the boat. Others were so weak and cold that they could not endure it. They went ashore, and with much hard work got fire, in spite of everything being wet. Later the rest of the people were glad enough to follow them for "after midnight the wind shifted to the northwest, and it froze hard. But though this had been a day and a night of much trouble and danger, God gave us a morning of comfort and refreshing." The next day was fair and sunshiny, and we found ourselves to be on an island secure from the Indians. We dried our clothes, fixed our fire pieces, rested ourselves, and "gave God thanks for His mercies."

"This being the last day of the week, we prepared to keep the Sabbath there." I need not tell you how, for you Pilgrims surely know. Ask, rather, of Master Edward Winslow, whom we so often call the brain of our little colony, how it came about that Plymouth was chosen for our final settlement.

Master Edward Winslow's story

There's little more to tell besides that which all ye good men and women know. Our shallop party was near the end of its labor. On Monday we sounded the harbor and found it fit for shipping. Things looked brighter in the daylight. The land which the night's storm hid from our sight now showed itself as we came near. We "marched up into the land and found divers cornfields and little running brooks, a place fit for situation for our colony. At least, it was the best we felt that we could find. The winter season and our necessity made us glad to accept of it."

So we returned to the big ship again with this news, which did much to comfort your hearts.

This dialogue given by the younger children will prepare your community for a more complicated play, with a real plot and several scenes. Besides giving them your Beauchamp Manor play, you can give for a Christmas entertainment "The Good Angels of Valley Forge." This play, also, was written by young persons; they were some two to four years older than those who wrote and staged the Beauchamp Manor play. It is based on the historical incidents connected with the fearful winter spent by our Continental soldiers at Valley Forge, and on the efforts of the wife of Governor Reed, of Pennsylvania, and of her friends to relieve the physical wants of those men as well as to send cheer to them at Christmastide. We have used as a substantial clue the correspondence that passed between Esther Reed and General George Washington on the subject. What the younger persons in this play do, is based, however, on probability and possibility, rather than on record. It is certainly in keeping with the spirit of the actual work done by their older relatives and friends.

THE GOOD ANGELS OF VALLEY FORGE

PERSONS REPRESENTED

Mrs. Reed, *wife of Governor Reed of Pennsylvania*

Mrs. Lacey,
Mrs. Joslyn,
Mrs. Carpenter,
Mrs. Whitcomb,
Mrs. Blackmore,
Mrs. Knutts,
Mrs. Sharpe,
Mrs. Dickson,
Mrs. Lloyd,
ladies devoted to the revolutionary cause

Mrs. Stewart,
Mrs. Daggett,
loyalist ladies

Barbara Tilghman,
Martha,
Libby Austin,
Faith Perry,
Laura,
Ellen,
Jerusha,
Mary,
Janice,
Jane,
Sarah,
Betty,
Dolly,
Dorcas,
Joanna,
Miranda,
young girls

Mammy, *Barbara's colored nurse.*

Act I, Scene 1.— *Mrs. Reed's parlor in Governor Reed's home in Philadelphia. Afternoon tea, Thursday, December 18, 1777.*

Scene 2.— *The same. Friday morning.*

Act II, Scene 1.—*Mrs. Reed's parlor. A sewing bee in progress. The following Monday morning.*

Scene 2.— *The fair. Monday afternoon.*

Act III. *The tavern ballroom. Wednesday, the day before Christmas. Packing-barrels and -boxes. Crack of whips and sound of sleigh bells outside.*

Act I

Scene 1

Scene.— *Mrs. Reed's parlor. Table set for afternoon tea. Mrs. Reed is adding finishing touches. Enter Mrs. Lacey.*

Mrs. Reed. Why, mother, didn't you take your nap this afternoon?

Mrs. Lacey. Oh, yes; a short one. I did not sleep long because I wanted to be down here to greet the ladies. I do hope they will come. (*Walks to window.*) It is a very cold, windy day. Perhaps they will not want to come through these snowdrifts.

Mrs. Reed. Don't you worry, mother. They do not have to be as careful as you do, and the cold weather does not trouble them so much as it does you. (*Footsteps in hall.*) Why, who is this? It is too early for the ladies to come. (*Enter Barbara.*) O, Barbara dear!

BARBARA. Oh, Aunt Esther, Aunt Esther, I was so afraid some of the ladies would get here before I did, and I had something to tell you alone. It is this. I do so want to do something for Dick and the other soldiers at Valley Forge. Just think of their having to spend their Christmas in camp! What can we do, Aunt Esther, and when can we begin? This is Thursday and there is only a single week before Christmas. Laura and Ellen are coming over later; we thought you could suggest something for us to do. I believe all our girls will help gladly.

MRS. REED. Wait till after tea, child; then I will be glad to help you. So will some of the other ladies. But there will be some ladies here at tea who do not sympathize with our cause, so we must wait until they are gone.

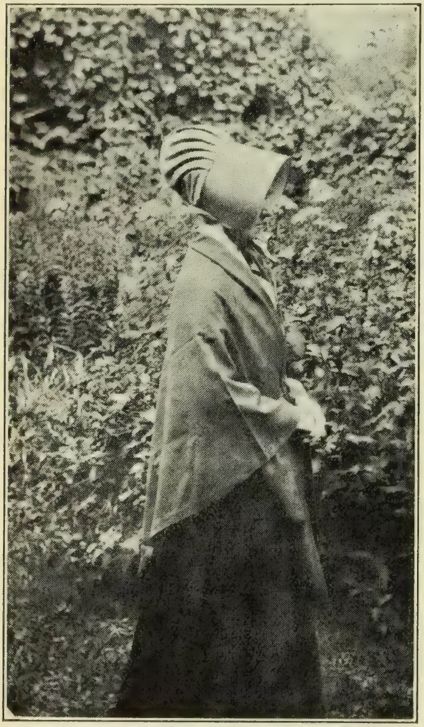


FIG. 138.— *A Quaker costume*

BARBARA. I wonder if Mrs. Daggett, Mrs. Stewart, and the other loyalist ladies will come.

MRS. REED. I invited them. You know that your uncle, as Governor of Pennsylvania, serves all its citizens, so that my hospitality must include loyalist and patriot alike. What is it, mother?

MRS. LACEY. Here comes a sleigh. I think it is going to stop here. I cannot see who is in it. Some one with a — why, it is Mrs. Joslyn! Yes, and Mrs. Blackmore and Mrs. Whitcomb are with her. I do so like to have company.

MRS. REED (*laughingly*). Mother dear, you are just like a child in your glee and excitement.

(*Enter the three ladies. Mrs. Reed helps them remove their shawls and bonnets. Barbara slips out after greeting them.*)

MRS. LACEY. Here comes Mrs. Carpenter with that queer Mrs. Knutts — and here is another sleigh! It is Faith Perry and Libby Austin, those sweet little Quakeresses, and Mrs. Lloyd is with them. What a sad Christmas it will be for Mrs. Lloyd without her husband!

MRS. REED. We must help her to forget her sadness. Who is in the sleigh?

MRS. LACEY. Why, Mrs. Daggett and Mrs. Stewart, to be sure. Mrs. Daggett looks as if she were coming just to be polite and did not really wish to come.

MRS. REED (*reproachfully, and quietly putting her hand on her mother's shoulder*). O, mother, your heart is really kinder than your words would make it seem.

MRS. LACEY. Humph! I do not see any one else coming. Yes, there is a lady way down the street.

(*Enter other ladies, talking quietly while they remove their wraps.*)

MRS. LACEY (*as she greets Mrs. Joslyn*). You are brave to come out on such a day! This has certainly been one of the hardest winters I have ever seen. It has been twenty years since we have had such a snowy Christmas as this, and well do I remember that one.

MRS. JOSLYN. Have you been quite well lately, Mrs. Lacey, in spite of the severe weather?

MRS. LACEY. My rheumatism is much better, thank you, but my heart has troubled me greatly. I do not think the constant excitement has done me any good.

MRS. CARPENTER. I do not think it has done any of us any good. There has been plenty of it, however.

Libby. Would thee be surprised to learn that a loaf of bread froze in our pantry last night?

Mrs. Whitcomb. Why, I never heard of such a thing. If bread is freezing in our houses, what can our poor boys at Valley Forge find in condition to eat?

Mrs. Blackmore. Have any of you heard from the soldiers lately?

Mrs. Reed. Barbara, my niece, received a letter from her father, Colonel Tilghman, yesterday. He says that the soldiers are having a pretty hard time. The rations are scarce, and the clothing is almost threadbare. He minds the cold extremely, himself, for he has lived in the South so many years. Perhaps it seems colder to him than it does to the other men.

Mrs. Stewart (*changing the subject*). This is very nice tea you have, Mrs. Reed. Where did you get it? I don't wonder you were tempted to buy it.

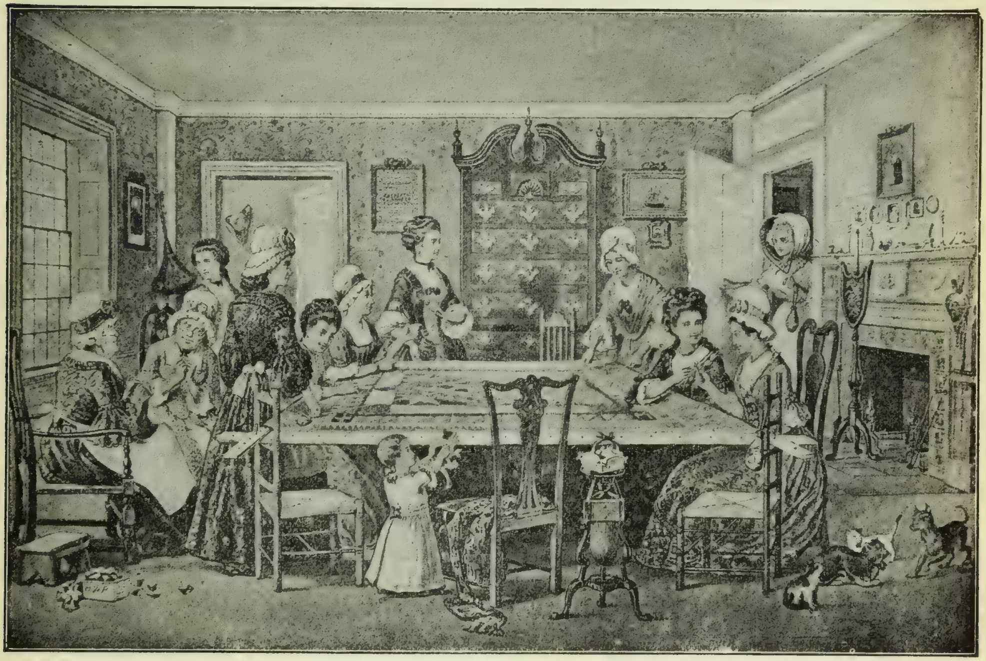


Fig. 139.—*A quilting bee*

Mrs. Lacey (*without waiting for Mrs. Reed to answer*). Why, we bought it from the grocer. Did you think it was smuggled?

Mrs. Reed (*embarrassed*). Why, mother!

Mrs. Lacey. Well, she acted as though she did. We patriots never objected to buying tea from England as long as it wasn't taxed. (*Settles back in chair.*)

Mrs. Stewart (*obviously trying to change the subject again, clears her throat*). We are going to have a quilting party at our house next week, and we hope the ladies will all come. I want to finish my quilt because I expect company for Christmas.

Mrs. Reed. I am sorry, Mrs. Stewart, not to promise to come, but I shall be too busy making preparations for our Christmas festivities. (*Clock strikes five.*)

Mrs. Daggett. Five o'clock! I must go. I am to be at the church sociable at seven. Don't you think we had better start right now, Mrs. Stewart?

Mrs. Stewart. Is it as late as that? Yes, I'm afraid we must go.

Mrs. Carpenter. I guess we must all begin to go soon.

Mrs. Daggett. We've had a very pleasant afternoon — much better than we expected to have. I'm sorry you cannot come to our quilting bee, but I suppose you know your own plans and have more important engagements (*sarcastically but politely*).

MRS. LACEY (*aside*). Did you ever!
MRS. REED (*aside*). Sh-h-h, mother.

(*Exit Mrs. Stewart and Mrs. Daggett to the evident relief of all. Enter Barbara, Laura, an optimist, and Ellen, a pessimist.*)

LAURA. O, Mrs. Reed! We've been waiting half an hour for those loyalist ladies to go.
MRS. REED. Why, what is your hurry and excitement, girls?
BARBARA. I have just got a letter from Dick. (*General exclamations.*)
MRS. BLACKMORE. Did he say anything about my husband, Miss Barbara?

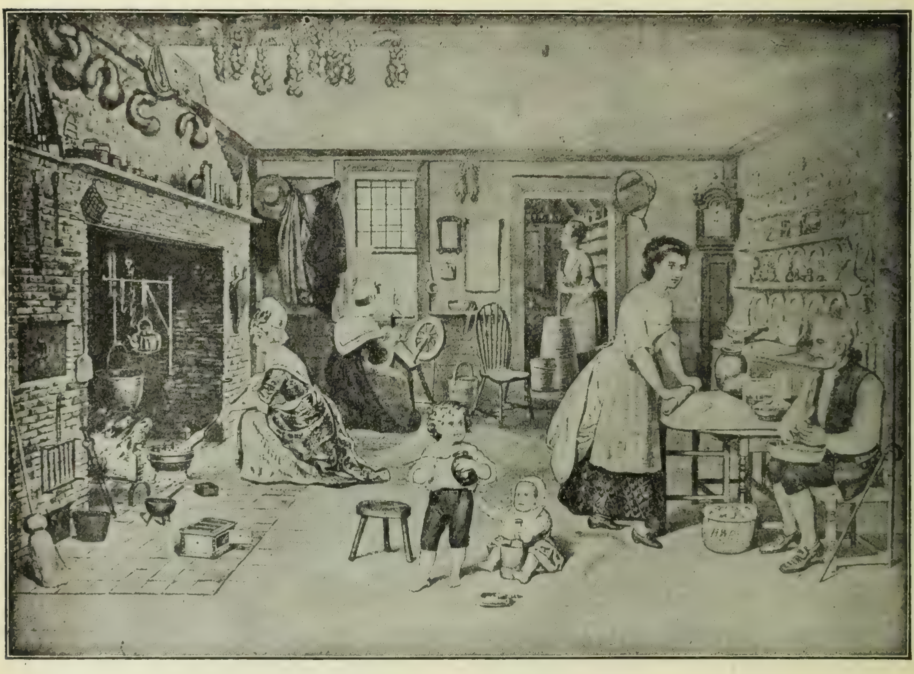


FIG. 140.— *A colonial living-room*

MRS. REED. What did he say, dear?
ELLEN. Oh, they're all freezing and dying at Valley Forge and we cannot do anything for them.
BARBARA (*begins to read letter aloud*). "I do not know what the outcome of all this——"
LAURA. That's not the way it begins, for I saw it myself. It says, "Sweet Mistress Barbara."
MRS. LACEY. There, there, children!
LAURA. Now begin, Barbie, at the beginning and don't leave out a single word.
BARBARA (*obediently but blushingly, reads the letter aloud*).

"Headquarters, Valley Forge
December 15, 1777

"Sweet Mistress Barbara:"

(*Barbara reads a little, low to herself, and says aloud*) This part is really private. (*She blushes, clears her throat, and begins again.*) "As you see, I am keeping my promise in writing you about the real conditions. What the outcome of all this famine and sickness will be, I dare not think. What food we do have is not fit to eat. When I think of the clear, cold, spring water we used to waste at home, I groan. None of us dares to call up the mental pictures of the comfortable rooms in our homes. The men are all in rags. Many have no shoes, their stockings are in ribbons, their shirts in strings, and oh, it is so cold that we all sit huddled together trying to get warmth from smoke and the stubborn camp fires. Do you remember those kerchiefs you gave me before I left? I used half of the last one to-day to tie on my shoe. I look forward to the day when I shall return and we may carry out all those plans you and I have made. Without food, without spirits, and with our soldiers sick and dying, we still fail to quail, or to reconsider as England wishes us to do ——" (*Reads to herself, then says aloud.*) There is some more that you would not care to hear. O Aunt Esther! Can't we do something, send some comforts to those poor fellows?

ELLEN. We could never get anything there.

LAURA. Yes, we could and we will. If there are not any men to go with them we can go ourselves. Father has a new sleigh and I can drive.

(*All the older ladies look shocked at this daring independence.*)

MRS. JOSLYN. That is impossible, child!

BARBARA. Can't we get something ready for Christmas? It's just a week from to-day. (*Enter Mammy.*) O Mammy, have you come after me in all the snow? You're such a dear.

MAMMY. Yes, honey chile, I'se come to fetch you safe home. Yo' daddy's come back.

BARBARA (*not hearing last remark*). Just wait one minute, Mammy, we're planning something.

MRS. REED. It's getting late, dear, and it is snowing hard. Why not wait until to-morrow and talk it over? I, too, had a surprise plan for our soldiers.

MRS. BLACKMORE. To-day is the eighteenth. We have six days before Christmas.

MRS. JOSLYN. Why can't we meet to-morrow and plan definitely just what we will do?

MRS. CARPENTER. We could meet at nine o'clock and get right to work before noon.

MAMMY. Come, chile, come.

BARBARA. O Aunt Esther, I'm so worried about Dick.

MRS. REED. Never mind, dear. Did you hear Mammy say your father had come back? Perhaps he will tell you things are brighter than Dick pictures them. Good-by till morning.

(*Barbara goes out with Mammy. Exit also Ellen and Laura.*)

MRS. LLOYD. How dear that child is! I overheard the girls say this afternoon that Martha Long has been very disagreeable to her lately. Why, do you suppose?

MRS. JOSLYN. Well, I think the girls have spoiled Martha a little bit. She has always been the most popular girl in the town, and then to have the girls make so much of Barbara, a new girl this winter, hurts her. Even Jerusha seems to worship Barbara.

MRS. SHARPE. I think Martha is jealous of Barbara on account of Dick.

MRS. LLOYD. Why should Martha be jealous on account of Dick?

MRS. SHARPE. Well, Dick has been very friendly with Martha, and seemed so much attracted to her that all the girls had been teasing Martha about him this summer. Then his affections were suddenly transferred to Barbara when she came north this autumn.

MRS. BLACKMORE. But, Mrs. Sharpe, Dick and Barbara are old friends. They lived in the same town down South, and went to school to their rector's daughter together. Their people were very close friends, for Dick's father and Colonel Tilghman grew up together also.

(*Other ladies look interested and somewhat astonished.*)

MRS. SHARPE. Is that so? Well, that surely is news to me.

MRS. JOSLYN. Dick is certainly a fine lad. I guess all the girls admire him.

MRS. LACEY. I guess he likes our Barbara better than any other girl.

MRS. JOSLYN. Well, I do not wonder at that. Barbara is a lovely girl.

MRS. LACEY (*with spirit*). Of course she is.

MRS. REED (*shakes warning finger at her mother*). Mother, don't be too fond of a relative; you might be called prejudiced. Now let me see, friends; we haven't time to talk things over more to-night. I think the girls are right. Governor Reed and I have already discussed a similar plan. In short, I am in correspondence with General Washington, who advises me to give the poor fellows shirts rather than money. We will let the girls make their gifts now at Christmas, and we will save ours quietly for General Washington's own birthday. Could you all come here to-morrow in spite of snowdrifts, and begin work before sunset? Here, Mrs. Knutts, let me tie your bonnet more securely. Well, Libby, I hope we shall see you and Faith to-morrow?

FAITH. Thee is very kind. We will do our best to come, thee may be sure.

CURTAIN

Scene 2

SCENE.— *Same as Scene 1. The following morning. Curtain rises on girls and ladies gathered in Mrs. Reed's parlor.*

JERUSHA. Here we are — all hands and heads ready for work! We girls will use our hands if only you wise grown-ups will direct us.

MRS. REED. The question for the men of the province is, What can we do to send the redcoats home? The question for us women is, What can we send to Valley Forge to make our soldiers feel more as if they were at home, for Christmas at least?

MRS. BLACKMORE. Now, what shall we send? boxes or barrels? food or clothes?

MRS. REED. Both, I think. They surely need both food and clothes.

JERUSHA. Don't forget that molasses cookies taste good at an out-of-door picnic.

ELLEN. I guess those will freeze before they reach the soldiers.

BARBARA. Oh, no, they won't; if we pack them well, how could they?

MRS. CARPENTER. Why can't the girls look after the cooking, and we women do the sewing? There will be shirts to make and wristers to knit.

FIG. 141.— *A colonial toy*

MARTHA. How can we raise money for material?

JANE. Couldn't we have a fair?

ALL. Oh, fine! fine!

MRS. REED. That is a good suggestion — to raise money by a fair; but you would have to hurry tremendously to make the necessary articles for the fair, and then to make the clothes for the soldiers before Christmas.

ELLEN. I don't see how we could ever do it.

(*A faint sound is heard — " chirp-chirp "*)

JERUSHA. Barb, you ought to know how such things are done; come and tell us how to start a fair.

LAURA. Now, I should begin by taking a collection from the people right here, and going straight to the store.

BARBARA. Let me think.

(" *Chirp-chirp* ")

MRS. CARPENTER. What is that noise?

BARBARA. I have an idea, girls. Why not put all the Christmas presents we have made for our friends, and all the toys we have bought, into the fair and sell them? I have a hamper full of gifts ready to send, and I'm sure my friends would be willing to sacrifice such little things for so great a cause. This would save time, too.

JERUSHA. Hurrah for Barbara! She is our leader!

(*Martha looks surprised and tosses her head. " Chirp-chirp-chirp "*)

MRS. WHITCOMB. There is that noise again. Have you anything in your pocket, Jerusha? It's over your way.

JERUSHA. No, Mrs. Whitcomb, I haven't anything — not even money there.

MARTHA. So we are going to have a fair. That is settled. Where are we to hold it?

JERUSHA. Have it in the church vestry to-morrow.

ELLEN. You know we can never get it ready for to-morrow, Jerusha; and as for having it in the ——

LAURA. Why not have it in the ballroom of the tavern? The room is large.

("*Chirp-chirp*")

MRS. BLACKMORE. If we can engage it for that time Monday afternoon, it will be very good. Why not have it right here? There's plenty of room.

MRS. REED. I think we can, and we'll have the crier call attention to it this very afternoon and evening in the busiest streets.

JANE. Did your father come home last night, Barbara?

BARBARA. Yes, Jane.

JANE. Oh, what did he say?

MARY. He must have had ever so many things to tell.

("*Chirp-chirp*")

JERUSHA. Tell us what he said, Barb.

("*Chirp-chirp*")

MRS. CARPENTER (*going over to Jerusha and taking her by the arm*). Well, now, Jerusha, you must have something about you to make that noise!

JERUSHA. Do any of you girls see it?

MRS. REED. Jerusha Weatherhead, you have plagued and delayed us long enough. Take that out of your pocket or hand.

(*Jerusha places a cricket on the floor near Martha, who screams.*)

MARTHA (*screams*). Oh, a horrid cricket!

BARBARA. Never mind, Martha, it's only a joke.

LAURA (*impatiently*). Now tell us about your father, Barbara.

BARBARA. Yes, with pleasure. Father says the soldiers have been greatly cheered by the visit of the Marquis of Lafayette to the camp at Valley Forge. He believes that Burgoyne's defeat last October will hasten the French alliance. You know our Benjamin Franklin is over in Paris and he has written Lafayette about his plans based on the glorious success at Saratoga. The Marquis and father have come to Philadelphia to see Congress about some affairs of state. I do hope Congress will show Lafayette every courtesy. Pardon me, Mrs. Sharpe and Mrs. Whitcomb, and all of you, for talking so long. I get so interested in what Lafayette is doing for us.

MRS. WHITCOMB. No apologies are necessary, child, we were all eager to hear. I like to hear these things about our generous foreign friends Do you suppose France really sympathizes with us and will aid us openly?

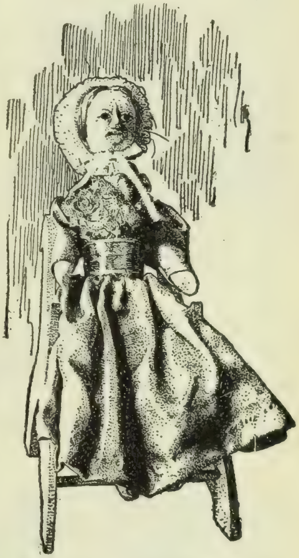


FIG. 142.—*A colonial doll*

MRS. SHARPE. My husband says France will probably help us now, but only because she hates England and can strike the hardest blows at her through aiding us.

ELLEN. Perhaps even Lafayette is not our true friend.

JERUSHA. Ellen, you certainly are an incorrigible pessimist. Lafayette is a friend of ours, so there! Two cheers for him, three for Barbara! Come on, give them, girls!

MRS. JOSLYN (*holding up her hands to quiet them*). Now, Jerusha, we have joked enough. We must get to work. All of you girls keep over on that side and make plans, and let us ladies have a quiet spot to think in over here.

(*Martha rises to go.*)

BARBARA. Why, Martha, are you going so soon?

MRS. REED. Don't hurry, dear, but remember if you must go that we shall have the sale on Monday evening, and sew here all that morning.

(*Exit Martha.*)

LAURA. Barb says she has some Christmas gifts to give. So have I. I have several pairs of knit socks and three pairs of boot buckles that I have polished up and bent back into shape. Mother has two velvet snuff-pouches which I can tease away from her. Wouldn't these things help? I'm going to offer even my sampler for sale.

JERUSHA. We are not having a rummage sale. Besides, Barbara needn't give my Christmas present to the fair, I want it myself.

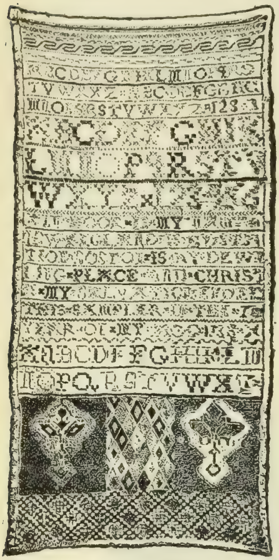


FIG. 143.— *A sampler such as every girl made in colonial days*

LAURA. How did you know she had one for you?

MRS. WHITCOMB. Oh, come now, you girls are fooling again. Mrs. Reed, could we sell some preserves? I have several jars of barberry and of apple. We might sell a few jars and send the others in the boxes to the soldiers.

MRS. BLACKMORE. Good, Mrs. Whitcomb; you are well known for your jam.

MRS. REED. Now it is decided, is it not, that we shall sell our Christmas gifts, trinkets, preserves, odds and ends, aprons, and kerchiefs? Is there anything else?

MRS. LACEY. Yes, I have several lavender bags, and two warm knit jackets that you may have.

MRS. CARPENTER. I bought six yards of chintz yesterday. That I can make up into a dozen or more comfort bags.

MRS. DICKSON. That is a good suggestion. We could make more, and if they do not sell at the fair, we can send them direct to the soldiers. I have several house plants in bloom that I will contribute to the sale.

Mammy enters quietly.

MRS. SHARPE. We shall have a great many shirts to make. Some ladies can cut them out, some can fit them, and others can sew them.

JERUSHA. What shall I do?

BARBARA. I move that Jerusha be our model to fit the shirts on.

LAURA. I second the motion. Isn't that what I should say?

MRS. LACEY. Jerusha's shoulders are quite broad, but I am afraid the men will need larger shirts.

MRS. JOSLYN. If we start to-day to get our friends together to help, we ought to be ready to sew all day to-morrow. Some may give us ready money to buy cloth with. Where shall we buy it? Loyalist storekeepers have flourished best since the British took up residence here in September. Just wait till the tide turns and we patriots come into our own.

(*Cries of "Hear! Hear!"*)

MAMMY (*rises and comes to center of group*). Doan you all worry about money, chilluns. I'll look after dat. Hee-hee!

MRS. REED. We didn't realize you had come in, Mammy. Sit down and rest yourself.

JANE. What about food? When and where shall we cook?

MAMMY. I should think that Tuesday and early Wednesday morning would be time enough to cook. We'll do that in our own homes, won't we?

LAURA. Barbie can tell you; she has charge of the fair.

BARBARA. But Aunt Esther has charge of the barrels and boxes. Ask her.

JERUSHA. What if Martha had heard Laura say that Barbara had charge of the fair? Oh, I must go. No, don't move, Barb, I can find the door. (*Exit Jerusha.*)

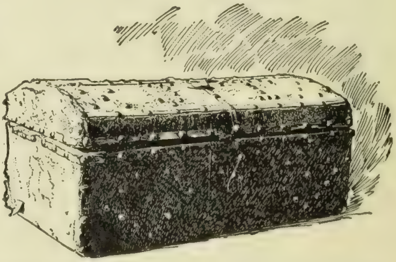


FIG. 144.— *Trunks such as our revolutionary ancestors used*

MRS. WHITCOMB. I should like to care for that impulsive child for about one week.

ELLEN. She is perfectly shocking!

BARBARA (*laughing*). I think we had better get to work on planning how we can get those barrels over the bad roads to Valley Forge.

LAURA. I know. We have a new sleigh and I will drive. I will take ——

MRS. CARPENTER. Nonsense, child.

MAMMY. Eh, what's dat? Sambo is gwine take all dose tings for yo'. He's a fixin' de pung up now.

BARBARA. You are such a dear, Mammy. Aunt Esther, please may I get the banjo and let Mammy play for us to sing?

MRS. REED. Certainly, dear; and then you girls must be on your way to invite people to the sewing bee on Monday.

(*Barbara gets banjo. Mammy plays and all the girls sing "Way down upon the Suwanee River."*)

CURTAIN FALLS AS LAST NOTE IS SUNG

ACT II

Scene 1

SCENE.— *Mrs. Reed's parlor. Sewing bee assembled. Older ladies gathered at one side, girls at another. Some are cutting, some sewing, some knitting. Mrs. Reed is the center of a group of ladies, Barbara of girls. Martha sits at edge of latter group.*

JOANNA. O, girls, we shall have to write letters to send in the barrels, or the soldiers will not know where all the good things have come from! Why not let Barb write the letters? She will know just what to say to cheer them.

JANICE. Good for you, Joanna, that's a fine idea and Barb is just the one to carry it out. Now, Barb, you stay right where you are (*as Barbara starts to get up*) and I'll bring pen and ink, and there is paper on the table.

(*Barbara laughs as Janice gently puts her into a chair by table. Jerusha jumps up suddenly and struts up and down stage singing two stanzas of "The Battle of the Kegs" to the tune of "Yankee Doodle." Girls sing chorus.*)

JERUSHA.—
'Twas early morn, as poets say,
Just when the sun was rising,
A soldier stood on a log of wood
And saw a thing surprising.

The soldier flew, the sailor, too,
And, scared almost to death, sir,
Wore out their shoes to spread the news,
And ran till out of breath, sir.

The kegs, 'tis said, tho' strongly made
Of rebel staves and hoops, sir,
Could not oppose their powerful foes,
The conqu'ring British troops, sir.

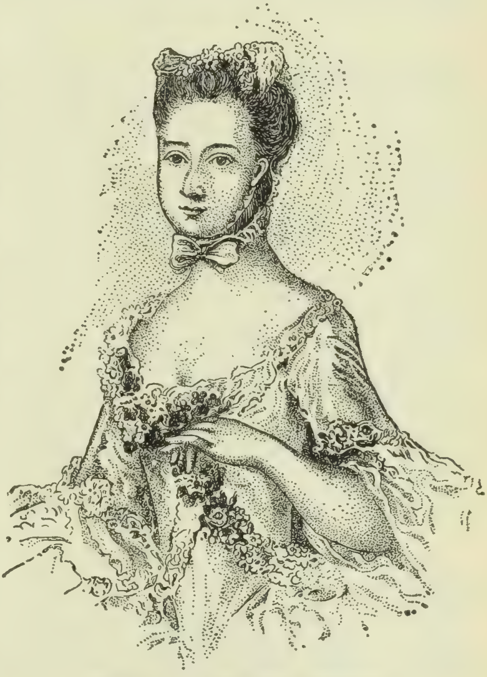


FIG. 145.— *Madame Riedesel*

MRS. JOSLYN (*laughs as they finish*). Where did you hear that song, Jerusha?

JERUSHA. I found it this week in the Philadelphia News, and Brother John says all the fellows left about here are singing it. Isn't it just great?

MRS. SHARPE (*to Mrs. Joslyn*). Isn't she a strange girl? I just want to laugh all the time she is here, and yet she puzzles me.

BARBARA. There, that is done. (*Flourishes letter.*)

LAURA. Let us see it.

BARBARA. I know there are a great many words spelled wrong, but please don't look at them. I never could spell.

(*Letter passes until it reaches Martha, who reads it with ill-concealed scorn.*)

MRS. CARPENTER. Isn't Barbara a dear girl? She is always willing and able to do her part.

MRS. BLACKMORE. Her mother was a very sweet woman, and I think Barbara is very much like her.

JERUSHA. Isn't it a splendid letter, Martha? I don't see how you know how to say such nice things, Barb.

MARTHA. Humph! It's all right, I guess, if you all think so. But it is just as hard to read this poor writing and wrong spelling as it is to read that of any one else.

JERUSHA. Well, what if it is? It isn't the writing our soldiers will look at; it is the thought that goes with the words. Barbara certainly can write better letters than any girl in the province. Can't she, Laura, dear?

(*Martha frowns.*)

LAURA. Of course she can.

BARBARA. Dolly, dear, do run and give this letter to Mrs. Reed. Mary, how do you make such lovely seams? O, girls, do you think I could make a shirt? I never took a stitch in my life.

JERUSHA. Of course you could, Barbie. At least you could do as well as Mrs. Knutts. She made a flannel shirt to send to her husband, who is a regular giant, as you know. Then she took it home and fitted it to Philemon, her ten-year-old son.

(*Girls laugh.*)

MRS. BLACKMORE. I wonder what Mrs. Knutts has lost now. (*Shakes head at girls to warn them that Mrs. Knutts is coming toward their group.*)

MRS. KNUTTS.[9] Dear me suz, have any of you little girls seen my thimble? I had it here a minute ago before I dropped my sewing. I must have left it at home. I'll have to send some one for it. Oh, lack-a-me!

LAURA. Why, Mrs. Knutts, there it is on your finger.

MRS. KNUTTS (*surveying finger*). So it is, child, so it is. Thank'ee kindly, my dear, thank'ee kindly. (*Goes back.*)

MRS. REED (*from across room*). The letter will do very well, Barbara, very well indeed.

FAITH. Ay, my dear, thee does finely at speaking out thy heart in comfort and cheer.

BARBARA. I am glad it will do, for it would be a task to write another when I so much want to learn to sew.

BETTY. Barb, do try to make a shirt. It would please Dick so much, if you would send it with his name on it. Do try.

MARTHA (*softly but distinctly*). Never took a stitch in her life, indeed! A pretty housewife she would make!

JERUSHA. My sakes, Martha, we've told you a dozen times why Barbara can't sew, and until to-day you have been glad to have her read to us instead. I am beginning to think you are jealous because you haven't some one to do all your sewing for you as her mammy does.

MARTHA. I should hope I am not so foolish as that.

(*Barbara crosses room to them.*)

BARBARA. Girls, girls! Martha, won't you please show me how to cut my shirt? They have provided me with cloth and pattern. You can do it so quickly and carefully.

MARTHA. Why, I — I —(*keeps on knitting*).

BARBARA (*cheerfully*). There, never mind, I was selfish. I suppose you *do* want to finish those socks. I'll do it myself; and I'll tell you what: we won't say a word about how badly it is done until I am through.

(*Barbara proceeds awkwardly and nervously to cut a shirt. Miranda enters breathlessly, with letter held aloft.*)

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[9] Mrs. Knutts wears a bonnet of straw with a model ship, about twenty-five inches long and five inches wide, resting on its crown. See "Two Centuries of Costume" for authority for such headgear.

MIRANDA. O, girls, I am sorry to be so late, but I got this letter from the Baroness von Riedesel and after I read it to myself I had to read it right away to mother and grandma. You will enjoy reading it, too. I'll pass it around. She writes that we should be proud of our American soldiers and officers. She says they are true gentlemen and she is deeply honored to know them.

MRS. BLACKMORE. The Baroness speaks very nicely of our soldiers and I'm sure we do feel proud of them. It is good to feel that our Continental army is made up of gentlemen as well as brave soldiers. Even this foreign officer's wife feels it so.

MRS. DICKSON. Do you suppose conditions are as bad at Valley Forge as Dick Sumner said in that letter, or was he trying to play on Mistress Barbara's feelings?

MRS. SHARPE. I fear they are. Won't those soldiers be glad when they open our boxes?

(*Martha goes up to table where Barbara is working, looks over Barbara's shoulder, and begins to laugh disagreeably.*)

MARTHA. You haven't cut it right. It is too small across the back and you've made two sleeves for one arm.

(*Barbara looks dismayed.*)

ELLEN (*aside to Laura*). Isn't she mean? Why doesn't she show Barb instead of standing by and talking when it is too late to help?

LAURA (*aside to Ellen*). Well, what can you expect? Martha is the only child of her family and is petted like a baby. The only reason she knows how to sew is because her mother and father went North several years ago and left Martha with her grandmother, who made her learn to sew. Martha didn't like it a bit. She thought she was badly treated at the time. I rather fancy that she's glad now that she knows how.

BETTY. She is so pretty that it seems hard to realize how unpleasant she can be. Oh, see! Here comes Dolly with the cakes Mrs. Weatherhead has made. Come, let's go over and look at them.

(*Girls drop their work and cross room to see the frosted cakes. Barbara is looking forlornly on the shirt.*)

JERUSHA. Don't you care, Barb. It's all right. Dick would wear it upside down if he knew you made it.

BARBARA. Oh, but, Jerusha, think of the material I have wasted! How stupid I am!

JERUSHA. You are not. The idea! We can piece it up, anyway. We can take some of the pieces and make a new sleeve. So don't worry a bit.

BARBARA. You dear old Rushy! Don't those cakes look delicious! (*Hurriedly wipes away a tear and goes across to join the girls.*)

(*Several ladies and children bring packages to the door but do not enter. Jerusha takes a small cake, divides it, and offers a mouthful to each girl. Martha refuses hers.*)

MARTHA (*shrugging her shoulders*). No, thank you, I don't care for any.

JERUSHA. Oh, do; my own mother made them! I know they are good, for I licked the dish! (*Girls laugh.*)

MARTHA (*aside*). I suppose she had to, as you keep only one servant.

(*Jerusha looks stunned for a moment, then raises her head proudly.*)

BARBARA. You cannot seem to understand that Jerusha's mother had a joy in making the cakes herself for our soldiers.

DOLLY. I wonder if we shall have any lunch. I do love company's lunch.

BETTY. Company's lunch?

DOLLY. Yes. When we have company, mother always has such nice things to eat. Teeny, weeny cakes and teeny, weeny cups of chocolate! Why don't we have lunch now? Everybody's company and there's such lots of goodies.

MRS. CARPENTER (*approaches her with basket of apples*). Why, Dolly, one might think you never had anything to eat at home. Don't be greedy.

DOLLY (*running to her mother and speaking excitedly*). Oh, yes, we do. No, I'm not.

(*All laugh.*)

LAURA. What lovely apples! Wherever did they come from, Mrs. Carpenter?

MRS. CARPENTER. Dear little Widow Lloyd provided them. She has a brother in Boston who sent her a barrel. It was very generous of her to give them to the soldiers when she finds it so uncommon hard to feed her own children. She gives away everything except her husband's regimentals, which hang over the head of her bed.

BARBARA. And yet she is so brave; she never complains and will accept nothing that seems like charity, for she says it would have made Mr. Lloyd uneasy and ashamed to think he had not left his family sufficiently provided for. I've tried so often. (*Sighs softly.*)

MARTHA (*spitefully*). So you could tell us about your good deeds? I am glad Mrs. Lloyd refused you.

(*All the girls look astonished, and by a common instinct draw away from Martha, who follows slowly but with head high.*)

MARTHA. I guess I don't have to be told twice when I am not wanted. Such rudeness was never before witnessed in Philadelphia. A stranger's influence must have begun it. (*Looks meaningly at Barbara.*)

BARBARA. O Martha, you know I would not do it. I would not hurt you for the world. Come, stay; be friends with us all.

MARTHA. No, I've got to go. Good-by.

(*Exit Martha.*)

BARBARA (*calling after her*). We'll see you at the fair this evening, Martha.

(*No answer. Outside door slams. Barbara turns away to hide tears. Ellen and Laura run to her and clasp her in their arms.*)

JERUSHA. Never mind, girls. The worst is to come. Revenge is sweet to Martha and we'll all be properly punished in due time.

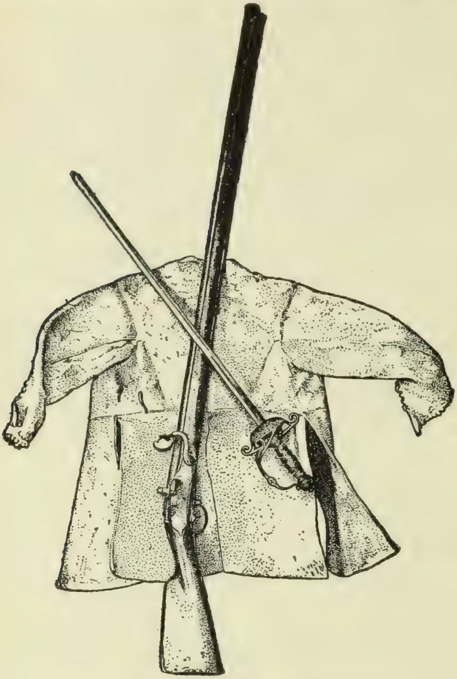

FIG. 146.— *Colonial regimentals*

LAURA. Woe be unto the girl whom Martha tries to punish! Well, we can't stop our fair preparations to see or wonder how she'll do it. Just think! In a few hours, the fair will be in full swing. The sermon yesterday got all mixed up in my thoughts with prices of bags and shirts.

CURTAIN

Scene 2

SCENE.— *Same as Scene 1. Fair in progress. Evening light. Girls behind tables. Ladies and children standing at tables or in groups talking quietly.*

BARBARA. Why, isn't it quiet here, girls! It is nearly seven o'clock and there are many things to sell yet. The minuet comes at eight.

ELLEN. I knew it would be this way. We won't take in enough to buy yarn for wristers even.

JERUSHA. Yes, Ellen, it's too bad. For once I agree with your pessimism. Martha, how many preserve jars have you left?

MARTHA. Not very many, Jerusha.

(*Mrs. Blackmore and Mrs. Reed enter and go to Barbara's table.*)

BARBARA. Good evening, Mrs. Blackmore. O Aunt Esther, I wish you would buy one of these lovely lace handkerchiefs.

MRS. REED. Just a minute, dear. I want some of these preserves. (*Walks away.*)

(*Enter Mrs. Dickinson with Dolly and Dorcas. They wander to different tables until they reach Jerusha.*)

JERUSHA. Mrs. Dickson, I knew you would like one of these knitted scarfs and I have been saving a pretty one for you (*nudges Mary, who is beside her*). And here is a linen kerchief just like the one you have on.

(*Mrs. Dickson examines scarf slowly and intently.*)

MRS. DICKSON. Come here, Dorcas, child, and let me try this scarf around your neck.

DORCAS. Please buy it for me, mother, please do.

(*Mrs. Sharpe walks up to table.*)

MRS. SHARPE (*patting child's head and then examining scarf under question*). Well, this is a real pretty scarf, Jerusha. How much is it?

MRS. DICKSON (*tightening her grasp on scarf*). I'll take both of these things.

DORCAS (*spies Barbara*). Mother, mother, may I go over to sit beside Mistress Barbara?

MRS. DICKSON. Yes, dear.

JOANNA (*standing at Martha's table*). How much are these strawberry and quince preserves?

MARTHA. Two shillings for the large jars. They are very rich. Will you have this jar?

JOANNA. No, I guess not. I think I see things at Barbara's table I'd rather buy.

MARTHA (*frowning*). Oh, all right. You'll get over it soon. If you knew what I knew, you wouldn't go near her.

DORCAS (*running up to Joanna*). Oh, yes, Joanna, Miss Barbara has some beautiful things at her table. See those bags and handkerchiefs!

JANICE (*to Mrs. Sharpe*). Why, Mrs. Sharpe, don't you think these large aprons are worth three shillings?

MRS. SHARPE. Three shillings! Why, they'd make wonderfully strong dory sails.

JANICE. I — I thought they would wear well; but I'm sure you would like a little chintz bag like this.

(*Mrs. Sharpe appears not to hear and turns away. Barbara and Jerusha go over to Janice's table.*)

BARBARA. What did she say about the aprons, Janice?

JANICE (*looking good-natured again*). Oh, I suppose the cloth is a little too heavy.

BARBARA. Well, she didn't mean to hurt your feelings. She was disappointed in the apron, that's all.

JERUSHA (*putting arm around Barbara*). I never saw the like of you, Barbie. You'd find something good about the most detestable living creature.

MARTHA. Laura, you've sold all your things, so come over here.

(*Martha takes a piece of paper from pocket and shows it to Laura, who looks astonished; both sit down and talk softly and rapidly. Barbara is gathering quilts at one side of the room as they do this.*)

LIBBY. And what is thee going to do?

BARBARA. We are going to auction off these quilts. Will you go and get the ladies together, please? (*Turning to Martha who is at next table.*) Martha, will you auction these off? Your voice carries well.

MARTHA (*coldly*). I think you could do it better than I.

BARBARA. Please do.

MARTHA. Thank you, I don't care to.

BARBARA (*jumping to top of table where quilts are piled*). Who bids first?

MIRANDA. Two shillings for that one.

LAURA. My goodness, I'll give seven.

MRS. SHARPE. I'll give ten. It's good and warm, but homely enough to make your teeth ache to look at it.

BARBARA. All right, it goes to you, Mrs. Sharpe.

(*Martha takes Laura's arm and they walk away whispering significantly.*)

BARBARA. Now, what am I offered for these two nice dark ones?

MRS. REED. Why wouldn't it be a good idea for each of us to give a little and buy these for the barrels?

EVERY ONE. Fine! Fine!

BARBARA. Mary, you'll collect the money, won't you?

JERUSHA. Now we can have the minuet, girls. The sale is over.

BARBARA (*to Faith in a low tone*). How strangely Martha acts to-night! I cannot seem to get her to join us in anything.

JERUSHA (*who overhears*). Well, I'll try to get her for my partner and see if I can make her better-natured.

(*Goes up to Martha, who turns away. Jerusha quickly gets another partner. All girls except Martha join in minuet.*)

(*Minuet. Dance four figures.*)

BARBARA (*when music stops*). Why didn't you dance, Martha?

MARTHA. Oh, I didn't care to touch hands with a traitor to her country.

ELLEN. Whom are you calling a traitor?

MARTHA (*in a high-pitched voice that can be heard distinctly all over the room*). I can prove it as well as call it. She is right here before me. Listen! (*She unfolds a letter.*) There is a lot of nonsense here. I'll read only a part of it: "For a time after I left you, I was worried for fear some one had seen me leave your house. I hate to think even now of what would have happened to you if a soldier in a red coat had been found hiding in your home. But there, all's well that ends well, and both you and I have escaped. Please thank Mammy for the splendid lunch —— " (*Martha stops reading abruptly, looks with a significant air.*) I guess that's enough to show you the traitor in our own camp. Now maybe you'll appreciate my being loath to associate with her. (*Looks scornfully at Barbara, who looks angry at first, then draws herself up proudly and rushes from room.*)

CURTAIN

ACT III

SCENE.—*The tavern ballroom. Packing-boxes and barrels are scattered about. As curtain rises Barbara and Mammy are alone on the stage. Barbara is perched on the table, deep in thought. It is the morning before Christmas.*

MAMMY (*putting her arms around Barbara*). Dar, dar, honey pet! Doan you bodder yo' pretty haid 'bout dat lettah. Jus' you leave it all to yo' ole Mammy. She'll fix that Martha. Po' white trash! If I had mah hands on dat pesky chile dis minute ah'd —— (*stamps foot in anger, and chokes.*)

FIG. 147.—*A colonial tavern swinging sign*

BARBARA. But, Mammy dear, she was right. It was her duty to denounce a traitor, and she thinks I am one. Don't say anything to hurt her feelings, will you, Mammy?

MAMMY. Hurt her feelings, huh? Why, baby, ah'd like to shake her teeth out. But there comes de ladies, angel pet, so yo jus git behin' dar and watch yo' mammy fix her. (*Shoves Barbara behind the curtain, and busies herself packing.*)

(*Janice enters with Jerusha and several ladies. Women greet one another and begin to pack.*)

JANICE (*hotly*). I don't believe one word of it. I think that jealous Miss Martha wrote the letter herself. The mean old ——

MARTHA (*entering with careless ease and assurance*). Oh, is that so? Then why didn't she explain? Why isn't she here to-day?

JERUSHA (*from the depths of a barrel*). Mrs. Reed, Mrs. Reed! Mrs. Knutts has put this great heavy box on top of the mince pies, and now she has tried to put the doughnuts all loose on the quilts! (*Mrs. Reed quietly attends to the matter.*)

JERUSHA (*leaving her work to join Martha*). And how does my Lady Jealousy find herself to-day? Well, I trust. (*Makes a mock curtsy, then with sudden heat, as her anger gets the better of her, exclaims*) Oh, I think you are the horridest, meanest girl!

MARTHA. Whatever I am, I am *not* a traitor!

JANICE. You are just a mean, jealous girl, because you know that Dick likes Barbara better than he ever liked you!

MARTHA (*with satisfaction*). Well, Dick won't think much of this traitor — unless he is a traitor himself. (*Holds up a pair of socks.*) I guess I'll write a little letter, and put it in his socks, so that he can know the latest news of Barbara.

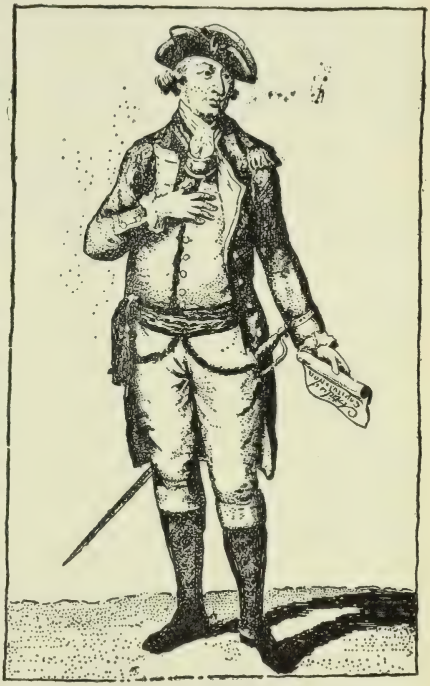

FIG. 148.— *A Continental soldier*

MAMMY (*stands out in their midst, visibly trembling, no longer able to contain herself*). Yo' mis'able piece o' low-down white trash. Yo' — yo' — yo' ain't got no decence ——

BARBARA (*rushing in*). Don't, Mammy dear!

MAMMY. Dar, chile, ah won't! But the ber' ideah ob dat good-fer-nuthin', stealin' yo' lub lettah out'n yo' blessed cloak!

BARBARA (*excitedly*). Don't, Mammy.

MAMMY. Ah'll have mah say, chile, an' nobody ain' gwine ter stop mah. Jus' 's if ah didn' let Mas'r Dick in de back windah mahself! Didn' ah mend dat tahr what was down de front ob dat mis'able pawn-shop red coat mahself? Didn' ah jes' know he hired dat coat so's to heah dem British officers talkin' in de tavern? Ah jes' guess Mas'r Dick's as good 'Merican as Washington hisself! Jes' 's if ah'd let mah lil' girl go an 'gage herself to one o' dem old Britishers!

BARBARA. Oh, Mammy! You have given away our secret! No one was to know that Dick and I were engaged until the war was over.

(*Men's voices are heard outside. Sleigh bells, whips, and impatient calls make a confused medley. Women who had been standing as if rooted to the spot now turn to their boxes and barrels. Jerusha and Martha stand close beside Barbara, and the other girls gather gradually around them.*)

JERUSHA. Isn't that just splendid, Barb, to think you are engaged already! I am going to be the first one to give you an engagement present. I'll go right off and get it! (*Turns suddenly, and gives her a loud kiss.*)

MARTHA (*speaks timidly, but sweetly*). Oh, Barbara, can you forgive me? I know I've been horrid. I've tried not to be, but it seems as if I couldn't help it — and I am sorry!

(*Steps near to Barbara, who takes first her right hand, then her left, and draws Martha to her as the curtain falls.*)

CURTAIN

This play has been given in less than two hours on a large stage to an audience of seven hundred people, with delight and satisfaction to all concerned. The costumes were all made by the same girls who wrote the play and staged it. The part of Mammy was taken by the only negro girl in the group, and was carried out so acceptably that the spectators applauded her again and again. For Barbara and Martha you must choose two very sprightly, pretty girls, Barbara being slightly softer in voice and slower in movement. For Mrs. Reed you need a tall, stately girl. As there were no boys available for this play, the part of men was kept literally in the background, as you have probably noticed, either by letting them stamp loudly at the back door of the tavern and crack their whips over imagined impatient horses, or by reading letters aloud sent from Valley Forge to the ladies. If the boys in your club wish, they may change [10] this play so as to admit of their presence by writing a scene or two to be laid at Valley Forge.

Such books as "Hugh Wynne," [11] by Weir Mitchell, and "Janice Meredith," [12] by Paul Leicester Ford, will give you more of the atmosphere and phraseology of the time; while the books of Alice Morse Earle, such as "Two Centuries of Costume in America," [13] "Home Life in Colonial Days," [14] and "Stage Coach and Tavern Days," [15] will give valuable definite aid in staging and costuming. For suggestions as to furniture, you can depend on Esther Singleton's "Furniture of Our Forefathers." [16] Perhaps the most helpful book of all for costuming problems will be McClellan's "Historic Dress in America," [17] for it has colored plates and detailed descriptions of costumes at definite dates.

By another year you and your community should be ready for a play, not only presented, but actually written, by the girls and boys of your town. Two rival groups, one of girls, the other of boys, could produce plays and compete, both as to the plot, the literary merit, the costuming and staging, and the presentation, for a prize. That might well be in the form of money taken from the door receipts, and devoted, by whichever group won it, to the purchase of permanent stage properties and a small working library for future dramatic work.

A capital theme for a boys' play, to be written and given entirely by them, would be Sir William Johnson's negotiations with the Iroquois Indians in early New York days. The cast would include Johnson himself, a group of white associates, and several groups of Indians — some Senecas, some Onondagas, and some Mohawks. The material for the plot may be found in Brodhead's "Documentary History of New York," [18] and in William Stone's "Life and Times of Sir William Johnson." [19]

---

[10] Do not hesitate to change any of these plays to suit your group and your posssible facilities for acting. It is only for publishing purposes that all rights are reserved to the author.

[11] Hugh Wynne. By Weir Mitchell. The Century Company. $1.50.

[12] Janice Meredith. By Paul Leicester Ford. Dodd, Mead & Co. $1.50.

[13] Two Centuries of Costume in America. By A. M. Earle. The Macmillan Company. (One-volume edition.) $2.50.

[14] Home Life in Colonial Days. By A. M. Earle. The Macmillan Company. $2.50.

[15] Stage Coach and Tavern Days. By A. M. Earle. The Macmillan Company. $2.50.

[16] Furniture of our Forefathers. By Esther Singleton. Doubleday, Page & Co. (One-volume edition.) $5.

[17] Historic Dress in America (1607–1800). By Elizabeth McClellan. John Lane, Vigo Street, London. $5.

[18] Documentary History of New York. By John R. Brodhead. O'Callaghan, Albany, New York. (Out of print.) This you may borrow from Albany by consulting the librarian of the University of New York.

[19] Life and Times of Sir William Johnson. By William Leete Stone. Munsell Company, Albany, New York. Two volumes. (Out of print.) This you may borrow from Albany by consulting the librarian of the University of New York.

The costumes and customs can be studied from Morgan's "League of the Iroquois" and Schoolcraft's "Notes on the Iroquois," both of which can be found, I suppose, in most New York libraries. Your leader might well be sent to Albany to visit the State Museum and to find profit and great pleasure in consulting Arthur C. Parker, the ethnologist in charge, who, as an Iroquois Indian and as an educated man, knows more about the matter than does any one else, and is at the same time cordially generous in helping persons who come on such a mission.

In Stone's "Life of Johnson," volume I, chapter II, you will find interesting facts about the hero's early life in the Mohawk Valley, where he was keeping a country store. In chapter XII there is a vivid description of a conference[20] at Onondaga and its happy results, in 1753. For variety of characters, and as an offset to Johnson's dealings with the Indians, you can introduce Governor Shirley and Lieutenant-Governor De Lancey, John De Puyster, and Peter Schuyler, jr., whose connection with Johnson's affairs appear in detail in chapter XIV of the same book. By letting an old man relate in an act representing 1754 or 1765 some of the facts of Johnson's early life, time can be saved for some action and speech at Johnson Hall in 1765 when affairs were tense and ominous.

This subject will be particularly well suited to the temperament and capacities of you boys. You will probably need the aid of girls only in costuming. The same books on furnishing and costuming for revolutionary times will help you sufficiently for fitting up the stage and for the dress of the white men of your play, while you can depend on Morgan's book and on models at the New York State Museum for the Indian dress.

The rival group of girls can revise and expand the extracts from a play called "The Avenging of Octavia," which is given below. The quotations will suggest the general outline of the plot and the style of presentation.

THE AVENGING OF OCTAVIA

PERSONS REPRESENTED

Mark Antony Octavius Caesar	*members of the Second Triumvirate*
The Horatii Cincinnatus Scipio Pompey Caesar Brutus	*apparitions*
Claudius Messala	*friends of Antony*
Octavia	
Cornelia	
Agrippina	

---

[20] From the Calendar of the Sir William Johnson Manuscripts, collected by the New York State Education Department in 1909, can be gathered clues to the speeches made at the Indian Conferences.

CLEOPATRA
MELITTA
IRAS
GREEK ARTIST
SLAVE
MESSENGER
MAID TO OCTAVIA
MAIDS TO CLEOPATRA
GREEK DANCER AT CLEOPATRA'S COURT

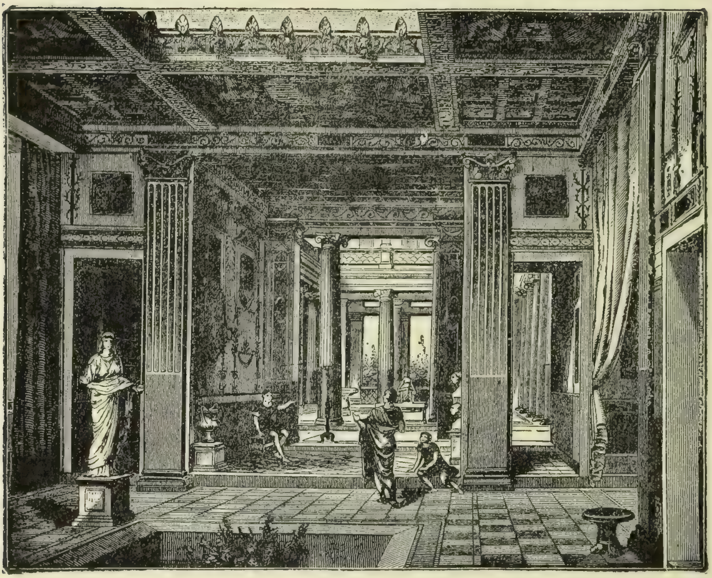

FIG. 149.—*Interior view of a Roman house*

QUOTATIONS FROM "THE AVENGING OF OCTAVIA"

OCTAVIUS. O my dearest sister, most beloved friend! Oh my wronged sister, what dost thou think of thy base husband? Would that he were dead at my feet rather than to have disgraced thy noble name! Why, he has even gone so far as to bestow Roman lands upon that vile Egyptian! Sister, by the great Zeus I will avenge thy wrongs and those of Rome! Thou hast been wronged beyond thought, and the high gods will do thee justice.

. . . .

ANTONY. Octavia, I have come to Rome to remain by thy side. Everything is to be righted. I had to give Cleopatra land to smooth the way and to avoid war. Henceforth, when I go to the East thou shalt come with me.

. . . .

ANTONY. Believe me, gentle Octavia, I am here to ask thy brother to relieve me of the Eastern provinces. I love Rome, my country; yea, the Romans, too, far better than the Egyptians, among whom fate put me as an exile amidst wearisome splendor. But affairs of state, Octavia, compel me to treat Cleopatra well enough to avoid a war. For the present, farewell, Octavia. Think of me sometimes. I shall be with thee in a short time.

. . . .

CLEOPATRA. Gone! Gone from me forever! Oh that I should lose him so soon! Married to Octavia, a meek, pale-faced Roman! Oh, the vile creature that he is, to have deserted me! He will never come back unless I devise some firm measure which will make him come.

. . . .

CLEOPATRA. But go, wretch, I have seen enough of thee. Married to Octavia! A Roman, too! Blind creature, knowest thou not how the Romans despise and hate thee?

. . . .

SCIPIO. Antony! Antony! Hast thou forgotten thy pride and ambition? Hast thou forgotten my attempts to entice the dreaded Hannibal away from Italy? Dost thou not remember how I won the battle of Zama? And now, wilt thou shame thy ancestral gods and make no attempt to win this battle, but instead flee after sin and luxury to soothe the pangs of a selfish heart? Beware, or on the morrow the battle will be lost!

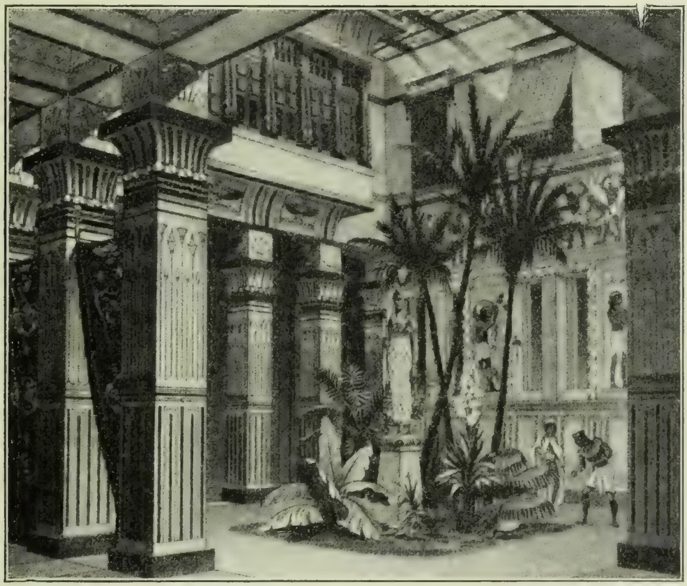

FIG. 150.—*Interior view of the home of an Egyptian noble*

. . . .

CLEOPATRA. Gone, too! Antony, my last hope, has gone and I am alone, utterly despised and hated by every one. Yea, I am a prisoner now! Oh, thou Octavia! How I hate thee; but I wish I were like thee! Yes, thou wilt triumph over me now. Oh, Antony, I have paid dearly for my folly and my wickedness, and Octavia, with her calm, smiling face, is avenged!

As the Roman toga could be donned on the stage by either boys or girls, the parts in this play were all taken by the girls. I have included a picture of the original cast, which, though the actors were called unexpectedly and were not grouped very artistically for the photograph, may yet help to give you some idea of the costumes. By using Johnston's "Private Life of the Romans"[21] and Breasted's "History of Egypt,"[22] you can work out details of stage and furniture for the interior views.

It may help you to read how these other girls wrote and prepared to stage their play. This account, written by one of their number, appeared in their school paper,[23] and gives a glimpse into their workshop:

> The play was written as a way of reviewing the period of Caesar, Antony, and Octavius Augustus. The history teacher told of other instances where classes had written plays for their history studies, thus making the lessons more vivid and lasting in their minds.
>
> The English instructors of the different sections cooperated and allowed us to take part of the time which we usually devoted to theme writing, for planning the work and writing the play. The details of the plot, scenes, and acts were written in one English section. This draft was given to another section to develop into dialogue. All that was required of the girls as a home lesson was to write at least one scene of the first act, but they could do more if they wished. Thus a number of the girls continued to work on it, writing the dialogue for the entire three acts. From these the best play was chosen and the finest pieces of dialogue from the other plays were fitted into this one, making the final draft.
>
> Then came the assignment of parts. The girls who were thought the most capable to take the principal parts — those of Antony, Octavia, Cleopatra, and Octavius — had been more or less in the minds of the teachers and the girls ever since the idea of the play first came.
>
> On our trip to the Boston Art Museum we spent a very busy afternoon studying the dress and arrangement of the hair from statuary. We went in behind one Roman lady to see how Octavia should have her hair arranged; we stood on tiptoe to examine the draping of the toga for the costumes of Octavius and Antony, and we studied the footwear of other Romans in order to make our own as nearly like the originals as possible.
>
> Three girls were chosen from the dressmaking section to design costumes, three from the millinery section to help with the armor, headgear, and shoes, and three from the domestic science section to furnish the palaces and gardens. A senior advisory committee was also formed to aid in rehearsals and to oversee the general details, such as selling tickets and planning the seating capacity of our hall.

The division of labor and the thorough study of detail described above gives us an example that may prove helpful to you in similar undertakings. If once you have worked out the plays suggested here, you will be ready for more plays, and more ambitious ones. I should be delighted to have young persons from farmhouses throughout the State of New York focus their attention and activities in the winter of 1915–1916 on a play called "The Dutch Patroons' Delights," a study and presentation of local colonial history. With such books as Washington Irving's[24] and Brodhead's to give the more general facts, and such books as Alice Morse Earle's "Colonial Days in Old New York"[25] and William Elliot Griffis's "Story of New Netherland"[26] to give the intimate details, you could make a fascinating play, with lively dialogue and attractive costume and with a strong opportunity for a well-developed plot. If I can help your leaders or your group with any suggestions, I shall be glad.

---

[21] Private Life of the Romans. By Harold W. Johnston. Scott, Foresman & Co., Chicago. $1.50.

[22] History of Egypt. By James Henry Breasted. Charles Scribner's Sons. $5.

[23] "The Shuttle." Published by the girls of the High School of Practical Arts. Boston, Massachusetts.

[24] Knickerbocker History of New York. By Washington Irving. G. P. Putnam's Sons. $1.50.

[25] Colonial Days in Old New York. By Alice Morse Earle. Charles Scribner's Sons. $1.25.

[26] Story of New Netherland. By William Elliot Griffis. Houghton Mifflin Company. $1.25.

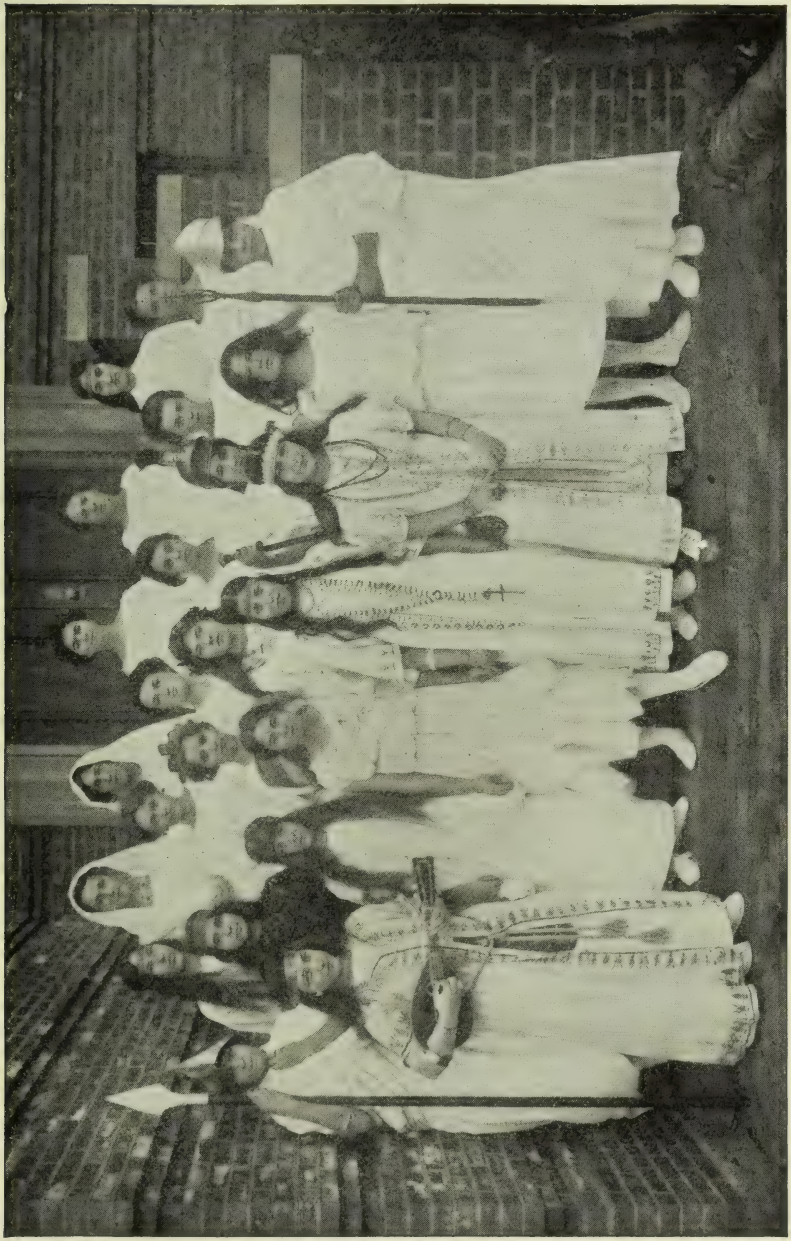

Fig. 151.— *Cast of "The Avenging of Octavia"*

For a slogan to keep up your enthusiasm and efforts during the preparation of each play — for of course there will have to be hard work as well as fun — it might be well to paint a good-sized sign to hang on the wall during each meeting of your group, with the simple inscription:

"Get the spirit,
Give the play,
Farmhouse girls and boys to-day!"

ACKNOWLEDGMENTS

The three plays "The Crusaders' Return to Beauchamp Manor," "The Good Angels of Valley Forge," and "The Avenging of Octavia," were written and presented by students of the High School of Practical Arts, Boston, Massachusetts.

The following acknowledgments are made for illustrations that have been courteously loaned to the writer:

Figs. 121, 122, 123, 124, 125, 126, 127, 128, 129, 130, 131, 132, 133, 149, 150, loaned by Longmans, Green & Co., New York City.

Figs. 134, 135, 136, 137, loaned by Silver, Burdette & Co., Boston, Massachusetts.

Figs. 139, 140, 141, 142, 143, 144, 145, 146, 147, 148, loaned by the Macmillan Company, New York City.

Fig. 138, loaned by Miss M. Jacobs, Auburn, New York.

Fig. 151, loaned by *The Shuttle*. (See footnote, page 1836.)

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

W. A. STOCKING, Jr., *Acting Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 65 JUNE 1, 1914 **RURAL LIFE SERIES No. 9**

FARMHOUSE AMUSEMENTS FOR GIRLS AND BOYS

DISCUSSION PAPER

If you will inform us somewhat in detail as to the entertainments that you have already seen or have taken part in, we can judge better how to help you with additional suggestions for new ones. It is hoped that you will answer fully and immediately the questions asked below. Address Reading-Course for the Farm Home, New York State College of Agriculture, Ithaca, New York.

1. What plays or musical entertainments have been given in your town during the last three years?

2. Will you send us a text or plot, or a brief story, of any one of these entertainments?

3. What group of people — such as a grange, a high school class, a Sunday School class, a Cornell study club, or a dramatic club — has given most of the plays that you have seen?

4. Where have these plays been given, that is, what building and what kind of a stage have been used? Have you a real stage in your town, or merely a platform with temporary curtains and improvised dressing-rooms?

5. How large an audience could you expect would come to your plays, judging from your past experience? What ages and interests would this audience represent?

6. Who would be the natural leader for you in such a winter's amusement as writing and staging a play? Will you need to search long, or at all, for him or her? Can we help you to persuade such a leader to carry out your winter's program, by promising our aid through further suggestions and definite advice?

Name..

Address..

Date..

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VOL. III. No. 67 JULY 1, 1914 CANNING CLUB SERIES No. 1

CANNING CLUBS IN NEW YORK STATE.—PART I. ORGANIZATION

MARTHA VAN RENSSELAER

The Department of Home Economics of the New York State College of Agriculture issued a lesson in the Reading-Course for the Farm Home in September, 1913, entitled " A Canning Business for the Farm Home." In that publication the Department encouraged the organization of county clubs similar to those in other States, for the purpose of utilizing

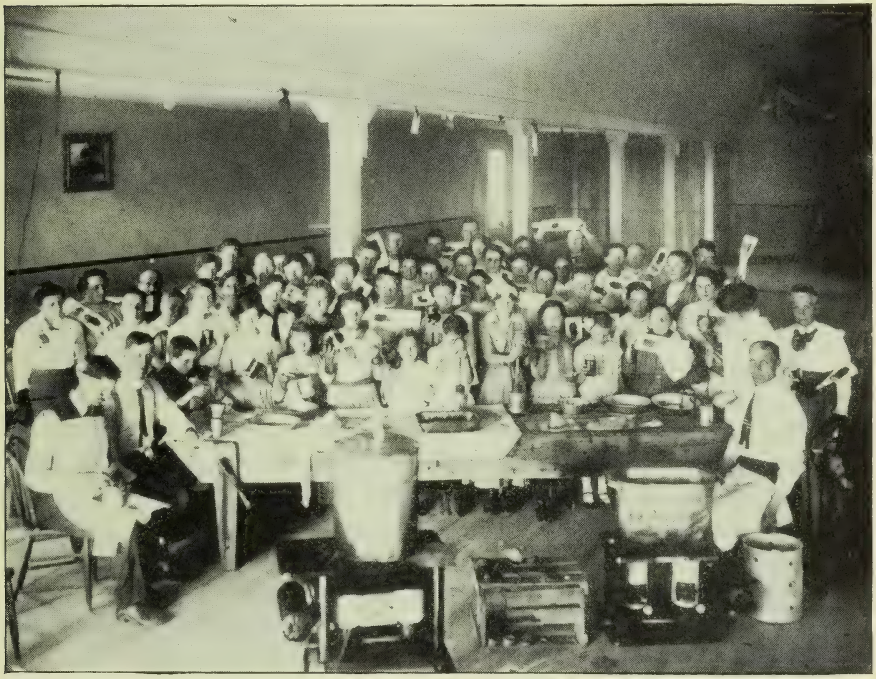

FIG. 152.— *A canning club and equipment*

the fruit and vegetables on the farm which might otherwise be wasted. The purpose of this lesson is to give further help in the organization of canning clubs. A number of such clubs have already been organized for work during the summer months of 1914. The object of such a club movement is to eliminate waste, to encourage the organization of young persons, and, by providing a money-making occupation on the farm, to show young persons the possibilities of the country as a place in which to earn a living.

THE ORGANIZATION OF CANNING CLUBS

Rules for forming a club

Some one in each community should take the lead. Talk the matter over with your neighbors, in order to determine whether there are at least fifteen or twenty persons in the neighborhood who would like to have a canning club. Although the club is essentially for the younger members of the community, yet the girls and boys need the cooperation of the grown persons; so do what you can to help them. The local leader of the club movement may be a teacher, a school supervisor, a grange master, a member of a Cornell study club, a young man or a young woman, an older man or woman — in fact, any capable person in the community who is willing to start the experiment and will make the work a success.

When the required number of members is secured, proceed as follows:

1. Appoint a place of meeting.
2. Elect a temporary chairman.
3. State the object of the meeting.
4. Elect officers.
5. Appoint a committee on constitution, a committee on program, and any other committees that are needed.
6. Let the secretary write to the Department of Home Economics at the State College of Agriculture, asking that the newly formed club be enrolled among the canning clubs of New York State.
7. Consult Lesson No. 13 of the Cornell Reading-Course for the Farm Home, on "Cornell Study Clubs," for suggestions as to methods of conducting club work.

What the College will do to help

A New York State organizer has been appointed by the Federal Government, who is a member of the staff of the Department of Home

Economics at the New York State College of Agriculture. When you have determined that a club of young persons can be organized in your community, notify the Department of Home Economics that you desire the assistance of the state organizer.

Personal instruction to clubs on methods of canning fruit and vegetables, of cost accounting, and of marketing, will be furnished by members of the college staff on application. The clubs will be visited from time to time by the club organizers, who will give instruction and will inspect and judge canned products.

Report blanks will be furnished, on which the secretary will regularly send to the Department of Home Economics reports of meetings and of work done in the clubs.

Printed labels, designated especially for the use of the canning clubs of New York State, will be furnished to club members who are keeping the required records, who have standardized their canned products according to the directions of the Department, and whose goods have passed inspection by some one of its representatives. Under no other conditions may this label be used. Club members will be the first to realize the necessity of such safeguarding of the use of the label, since a reputation for supplying goods of uniform excellence is absolutely essential to the building-up of a permanent demand for canning-club products.

Canning club requirements

1. The club shall be known as the ....Canning Club of New York State.

2. Club work shall be under the supervision of the Department of Home Economics, New York State College of Agriculture, Cornell University, Ithaca, New York, in cooperation with the New York State College of Agriculture.

3. Membership shall be open to persons twelve years of age or over. Housekeepers are urged to cooperate in this work so that they may assist in developing it.

4. A club shall consist of at least ten members, and the maximum membership shall be twenty-five.

5. Members shall agree to attend, if possible, all meetings called for instruction and in the interests of the club.

6. In order that fruits and vegetables used for canning may receive the club label, they must be confined to a very few products. Each club may help to decide, in consultation with the department representative, which products will prove most satisfactory in its particular locality. Wherever possible, tomatoes should be one of the products canned.

7. Only standardized recipes furnished or approved by the Department of Agriculture, Washington, D. C., or by the Department of Home Economics at the New York State College of Agriculture, shall be used by club members as a part of their commercial club work. Members are encouraged to try other recipes than those furnished by the Department for canning fruits and vegetables. Such canned fruits, however, are not to be labeled by the College. Results should be reported to the Department for recognition of the recipes.

8. Only such canned products as have received the approval of a representative of the Department of Home Economics shall receive the club label.

9. Members must keep an accurate account of all receipts and expenditures, after a method of accounting approved by the Department of Home Economics.

10. Although clubs shall be responsible for marketing their own products, such assistance as is possible will be given by the Department in order to further the establishing of permanent and profitable markets.

11. A notebook shall be started at the very beginning, in which accurate records must be kept. This is important, since without such a record it will be difficult to recall the details of processes and the dates of canning. Whenever requested, during the season, each member shall report progress to the secretary of the club.

12. The work of each club shall be graded somewhat as follows:

During the first year only four products may be canned which shall receive the club label.

During the second year, those persons who have already had the first year's work will be given other products to can and will be taught new methods of canning.

The third year's work will be further advanced.

13. At the end of the canning season each member shall furnish to the local organizer, and through her to the Department of Home Economics, a written account of her work for the season. The written account must be sent to the College on paper nine by eleven inches in size. The secretary will send the club report to the College.

WHERE TO FIND MATERIAL FOR CANNING

The success of the canning clubs depends largely on interest in producing the product. If possible, every member must cultivate at least one tenth of an acre of ground.

It is advised that tomatoes be planted in a part of this space, in order that all clubs and all members of a club may have at least one standard garden product. A few vegetables other than tomatoes may be raised, as, for example, beans or greens, depending on the soil and on the preferences of members.

As far as possible, the fresh vegetables thus produced should be used by the family or marketed, but the unused or unmarketed surplus should be canned. Adopt the motto " Let nothing be wasted." This will help to make good farmers and home-builders. Have the plot of ground as near the house as possible, and ask for the best soil that can be procured for the enterprise. In Part II of this series will be given a list of bulletins on vegetable gardening which may be obtained for the asking.

Thousands of bushels of cherries go to waste every year, and apples rot on the ground. Make a contract with the owner of the orchard, your father, or some other relative, for fruit which otherwise would be wasted. Can or preserve it for use when fresh apples and cherries are gone or are too expensive for daily use. Remember that baked apples may be canned, and apple sauce is good the year round.

Dandelions grow in New York State, whether we want them to or not. Canned dandelion greens taste as good as canned spinach and other domestic greens, to most persons.

COST ACCOUNTING

In order to make canning a good business proposition, cost accounting and the keeping of accurate records is a necessity. Report blanks will be furnished by the Department to club members, for estimating the cost of the season's work in canning. Each member is expected to fill out one of these report blanks and hand it to the club secretary as a part of her club work. The data for this summary are obtained from the notebook records kept during the season.

Cost of labor.— It is suggested that in estimating the cost of labor, the time of a person between twelve and sixteen years of age be valued at ten cents an hour, while the time of a person sixteen years of age or over be valued at fifteen cents an hour.

EXHIBITS AND PREMIUMS

Keep samples of canned goods for an exhibit. Ask the local agent to arrange for a display at a central point; it may be at the local fair or it may be at the State Fair. Contests and exhibits are matters for local decision. The Department of Home Economics will cooperate wherever possible.

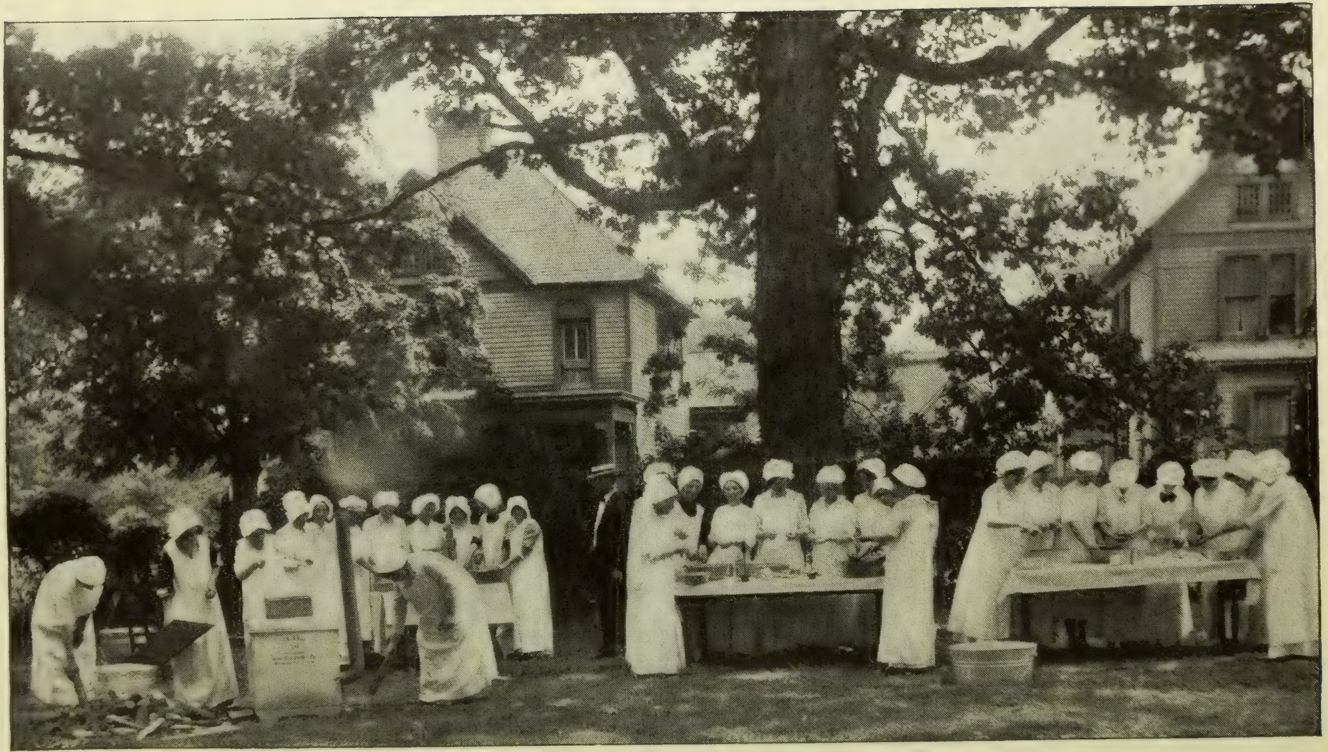

FIG. 153.— *A club in North Carolina, where out-of-door canning is common*

The College offers no prizes. Success is the best reward for effort, and the canning club label is the college stamp of success. There may, however, be some one in the community who would like to offer a prize for the best display of canned products. In that event the following suggestions may be of value:

1. That the local fair committee offer a prize to the club making the best display of not less than twelve cans showing variety of canned products. In case there is only one canning club in the vicinity, the prize may be offered to the member of the club who will show the best collection.

2. That the women's club offer this prize, and a central place be chosen for the display; or a merchant may give the prize and offer a place in his store window for the exhibit.

In making a list of premiums, the following general suggestions have been made by the Department of Agriculture, Washington, D. C.: (1) premiums should encourage the regular club work; (2) they should represent the greatest need and interest of the club members; and (3) they should teach the broad viewpoint of the club work, and encourage club members to do progressive and constructive work.

Suggestions for prizes

1. Garden and canning equipments
2. Title to a piece of land for a garden
3. Expenses of a trip to the New York State College of Agriculture for Farmers' Week in February
4. Books or magazines on gardening, and books on canning
5. A pen of thoroughbred chickens, a calf, or a colt
6. A winter-course scholarship to the New York State College of Agriculture
7. A fireless cooker, a sewing machine, or a vacuum cleaner

Basis of award for premiums used by the United States Department of Agriculture in its garden and canning clubs

Quality (both canned and fresh)	20
Quantity (both canned and fresh)	20
Variety canned	20
Profit on season	20
Story of "How I canned my crop"	20
Total score	100

Tomato score card for fresh products, United States Department of Agriculture

	Points	1	2	3	4	5	6	7	8	9	10
(1) Yield of fruit in pounds	40										
(2) Size — medium and uniform, rather than very large	10										
(3) Color — normal for ripe fruit	10										
(4) Uniformity of samples — smoothness, size, color, and shape	20										
(5) Shape and smoothness — freedom from cracks and surface blemishes	10										
(6) Evenness of maturity	10										
Total score	100										

Tomato score card for canned tomatoes

	Points	1	2	3	4	5	6	7	8	9	10
(1) Color when cooked	40										
(2) Quality of canned product — flavor, pulp, firmness, whole or mushy	40										
(3) Number of cans per bushel	10										
(4) Weight of cans and percentage of pulp	10										
Total score	100										

FIG. 154.—*Canning club at work in Cortland county*

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE
NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
Entered as second-class matter at the post office at Ithaca, New York
W. A. STOCKING, Jr., *Acting Director* A. R. MANN, *General Editor*
COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 67 JULY 1, 1914 CANNING CLUB SERIES No. 1

CANNING CLUBS IN NEW YORK STATE.—PART I. ORGANIZATION

DISCUSSION PAPER

Each club member, in order to be eligible to the use of the canning club label, must give a description of her canning experiments by answering the questions on the discussion paper. We shall be glad to have others answer the questions who have tried canning as a business venture. Write on a separate sheet all information for which there is not space here. Photographs will add greatly to your paper if you have been able to get them. Send to the Department of Home Economics, New York State College of Agriculture, Ithaca, New York.

1. How and why did you enroll in the canning club of . . . .
. . . . .county?

2. What is the object of the club?
    a. Commercial?
    b. For home use?

3. Did you grow your own crop? To what extent have you used products other than those that you grew yourself?

4. Give a description of your club plot.

5. What discouragements have you had in getting your product ready for canning? (For example, insect pests, frost, poor soil, chickens, lack of time, poor tools, poor seed, and the like.)

6. State the quantity, in quarts or pounds, of each product canned, and the size and number of cans; and estimate, as far as you can judge at the time of writing, the keeping qualities of the product.

7. What has been your greatest trouble in reaching a good standard of canned goods?

8. Which is the more profitable: raising vegetables and fruits to sell fresh, or canning them for the market?............................

How much have you sold fresh from the garden?....................

How much has been used fresh on the table?.......................

How many pounds or quarts have you canned in glass?............ in tins?..

9. Where have you disposed of your product?

10. Has the club work added to your interest and to your health?

11. Would you join a canning club another year if you had the opportunity?

What suggestions can you make for canning clubs?

12. Give name and address of the teacher or person who has been most helpful to you in this work.

Name..

Address...

Date..

Name of club..

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COURSE FOR THE FARM HOME. MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 69 AUGUST 1, 1914 CANNING CLUB SERIES No. 2

CANNING CLUBS IN NEW YORK STATE.— PART II PRINCIPLES AND METHODS OF CANNING

FLORA ROSE AND O. H. BENSON

The purpose of this lesson is to state principles of canning and describe canning methods in a way that will make them available to leaders and members of canning clubs.

WHY FOODS SPOIL

There are two main causes for the spoiling of foods: first, the presence of small living organisms that feed on the foods and change them so that they may cease to be desirable and may even become harmful; second, the normal occurrence in such foods as fruits and vegetables, eggs, meat, and seeds of all plants, of certain substances which, although not alive, are the products of living things and have the power of causing fruit to ripen, seeds to start growing, meat to soften, and final decay in all.

Any food that is still alive, or that may some day give rise to life, is subject to those changes that, for lack of a better term, may be called life processes. Yeast plants or bacteria may live on our foods and cause them to spoil. The gas produced from a can of fruit that is working, the odor of meat that is decaying, the mold on bread or meat or fruit, the rot and mold on eggs — all are typical results of the activity of micro-organisms and are well known to each of us. *Bacteria, yeasts, and molds grow everywhere — on ground, in water, and in air.* They are very light and are easily blown about, alighting on the surface of furniture, on our hands and faces, on our utensils, on unprotected and exposed food. Like all other forms of life they are in search of a living, and the clothes that we wear (as when mildewed), the foods that we eat, and even our bodies (when diseased), may all become foods for them. *All micro-organisms need the conditions of warmth, moisture, food, and oxygen to make them grow.* Warmth, moisture, light, and oxygen also favor the maturing, ripening, and decay changes occurring in eggs, meat, fresh fruits, and vegetables. From an understanding of these few simple facts, it has been possible to develop large and successful systems of food preservation, some of which are mainly commercial but most of which may find a practical household illustration.

Preservation of food by means of high temperatures

A temperature as high as that of boiling water is very destructive to the vitality of both micro-organisms and the foods on which they may occur. This destructive effect of heat is the corner stone of the method of food preservation that we know as canning.

Successful preservation of food by canning depends on two things: first, the complete destruction by heat of all life in or on the food, and on all parts of the can that are to come in contact with the food; second, subsequent care to prevent further entrance of micro-organisms. The process of heating a food as just described is known as sterilization.

The presence of air in a can will not cause food to spoil, provided the air is sterile — that is, provided it has been freed from all living organisms. A half-filled can of fruit will keep perfectly if the fruit, can, rubber, and cover are sterile, if the air space above the fruit is sterile, and if micro-organisms cannot enter the can. The precaution sometimes taken to run a knife or a spoon down the sides of a can in order to remove the few bubbles that may be there, is therefore not necessary. Unless the spoon or knife has been boiled, its use in removing air may even endanger the keeping qualities of a can of food, for it may hold organisms that thus find their way into the can.

Factors involved in canning fruit

It is now known that some micro-organisms that cause foods to spoil may assume two forms, the spore and the vegetative form. When conditions are unfavorable to their growth they go into the spore form, cease growing and reproducing, and become inactive and very resistant to the influence of heat. It is their method of tiding over a hard time.

In the spore form micro-organisms are much more difficult to destroy, and some of them are able to resist for several hours a temperature even as high as the boiling point of water. During a dry season spores occur much more frequently than usual on fruits and vegetables, and the difficulties of successful canning may therefore be greatly increased. *As soon as growth conditions become favorable — that is, when warmth, moisture, and food are supplied — spores begin changing over to the active, growing, vegetative type of organism, and in their greater liveliness they lose much of their power to resist heat and cold and other unfavorable influence.* These facts explain why sometimes canned foods may spoil even after long boiling and careful and complete sealing. The boiling temperature may not have been sufficient to destroy the spores, which soon change over to the active growing state. The problem of successful canning is, therefore, how may success be assured?

The commercial canner has solved the problem of sterilization by the use of steam under pressure. In this way he is able to obtain a temperature higher than the boiling point of water which is more destructive than that of boiling water; and when the temperature is high enough, a relatively short time of cooking is sufficient to sterilize all foods subjected to such a temperature.

The sterilization problem may be solved by the housekeeper by subjecting canned foods to intermittent sterilization in the following manner:

1. After a food is canned, boiled, and sealed it is allowed to stand for twenty-four hours in a warm place. This gives time for spores to change to the vegetative form.
2. The canned food is then cooked a second time in order to destroy the vegetative forms, and, still sealed, is allowed to stand for twenty-four hours in a warm place.
3. Since all spores may not have changed during the first twenty-four hours, it is safer to allow a second twenty-four hours of standing and a third period of cooking, in order to insure complete sterilization.

While the process of sterilization by heating foods intermittently for several days may be used for all foods, it is not necessary to take so much trouble with all. Fruits and tomatoes are much easier to sterilize than are the general run of vegetables, because they contain acids; hot acid, even if dilute, aids materially in destroying micro-organisms, both in the spore and in the vegetative form, during the cooking process. One day's cooking for a moderate time is therefore usually sufficient for acid-containing foods.

Many canned foods, even non-acid ones, may keep without intermittent sterilization if the time of boiling is long enough, but there is no absolute certainty about it. Variations in soil, moisture, and climatic conditions from year to year may cause a failure one year where success has always before attended the one-period process of cooking.

METHODS OF CANNING

Two methods of canning are commonly used both in the household and in the canning factory — the cold-pack method and the open-kettle method.

The cold-pack method

This method of canning is so called because the uncooked or partially cooked fruit, vegetable, or other food is packed in a can or a jar, some liquid — as water sirup, or juice (fruit, vegetable, or meat juice) — is used to cover the food in the can, and the can is then placed in a receptacle where it is surrounded with boiling water or steam and the cooking takes place. This is the method used by all canning factories for simple canned vegetables, fruits, and meats. It is also being adopted gradually by housekeepers, since in general it is a safer, easier way of canning most foods than the old open-kettle method, and the product keeps much of its natural flavor.

The great advantages of this method of canning are: (1) after the food is cooked, it does not have to be handled again; (2) the can or jar that is to contain the food receives as much heat as does the food itself, and is therefore as sterile as the food it contains; (3) the natural flavor of the food is retained.

The open-kettle method

This method of canning is so called because the food to be canned is cooked in a kettle, and only after complete cooking is it poured into the can or the jar that is to contain it. Unless the can or jar has been made sterile by being boiled for ten to thirty minutes before the food is poured into it, and unless the work is carefully done, there is always the risk that the food will be reinfected and that it may spoil after the can or jar has been sealed. For some products, as preserves, conserves, jams, and marmalades, for which condensation and heat more intense than that of boiling water are needed in order to produce the desired result, the open-kettle method must still be used. Therefore the steps in the process of open-kettle canning will be described, as well as those for the cold-pack method.

DIRECTIONS FOR CANNING

The following directions for canning tomatoes have been made as complete as possible, so that they may serve to illustrate canning processes which, with some modifications as to the time of cooking and methods of preparing materials, may be applied to all foods. This has made necessary much repetition, which, however, seems desirable if a clear view of each process is to be obtained.

The cold-pack method of canning tomatoes in glass jars

1. Select tomatoes that are ripe but not over-ripe, free from blemishes, and of medium size if possible. They should be red to the stem end, since green parts cause a poor product. Imperfect tomatoes may be saved and used for making catsup and purée, or made into juice to be used in filling the spaces left in a jar after it is packed with whole tomatoes.

2. Prepare the canning outfit — tables, chairs, utensils, fuel, fruit, water, salt, and sugar — ready for use.

3. Wash and scald the glass jars, tops, and rubbers, and put the rubbers to soak in cold water until needed.

4. Wash the tomatoes thoroughly.

5. Scald the tomatoes by placing them in a wire basket or a cheesecloth bag and plunging them into boiling water for one fourth minute to three minutes, according to the ripeness and condition of the fruit. This is called *scalding*. If scalding is prolonged to five or more minutes of active boiling, as is necessary for some vegetables, it is called *blanching*.

6. Dip the scalded tomatoes at once into cold water. This is called the *cold dip*.

7. Remove the core or stem end of the tomato first, and then slip the skin off. Any juice that escapes should be saved for filling the jars.

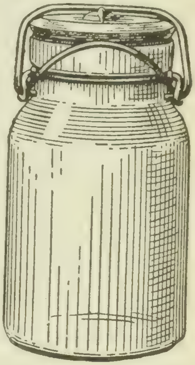


FIG. 155.—*Position of spring during sterilization*

8. Fill the jar carefully, with whole tomatoes if possible, until the fruit comes to within one fourth inch of the top of the jar. While filling, press the tomatoes close together with the bowl of a spoon.

9. Cover the closely packed tomatoes with tomato juice (not water) until the juice comes to within one fourth inch of the top of the jar.

10. To each pint jar of tomatoes add one half to one teaspoonful of salt and one half teaspoonful of sugar.

11. Place rubbers and tops on jars, and adjust the wire clamp *but do not snap it into place*.

12. Place the jars in a steamer or on a rack in a boiler, or according to directions that come with the canning outfit in a commercial canner. When the boiler and rack are used, nearly cover the jars with water. Cover the boiler and bring the water to the boiling point. Boil for ten to fifteen minutes. This is called *exhausting*, and the time of exhausting should be long enough to allow the contents of the jar to expand as much as is possible before the jar is sealed. If this is not carefully done with glass jars and further expansion takes place after the jars are sealed, the jars are likely to crack by pressure of the expanding contents. The time should be counted after the water begins to boil, not when the jars are placed in the canner nor when the water is merely hot.

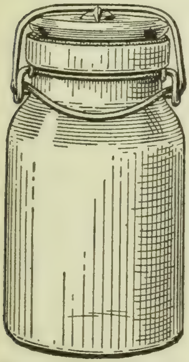


FIG. 156.—*Position of spring after sterilization*

13. Seal the jars after the exhaust period by fastening down the clamp.

14. Boil the sealed jars in the canner for fifteen to thirty minutes, according to the condition of the tomatoes, the size of the jar, and the kind of

canner used. Time-tables showing time differences for various fruits and vegetables are given in this lesson (pages 1869 and 1870). This process is called *sterilizing*, *processing*, or *boiling*.

(Read carefully the note on intermittent sterilization given at the close of these directions.)

15. Remove the jars from the boiler, steamer, or canner, invert them on a cloth, and cover them in order to protect them from drafts and thus prevent cracking of the glass.

16. Test the jars after several days by loosening the clamp and picking up the jar by the edge of the glass cover. If the seal is perfect the cover will not come off. In that case snap the clamp back into place.

17. Label neatly, carefully, accurately, and according to specifications that will be furnished. Grade and number the jars, and place them in tiers on shelves or pack them for shipment.

18. Enter in your notebooks the number of jars prepared, the cost of materials and time, and any other required data.

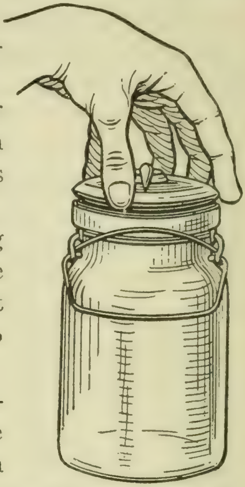


FIG. 157.—*Manner of testing*

A word about intermittent sterilization

If a pressure cooker is used, with which ten to fifteen pounds pressure is obtained and the temperature reached is considerably higher than that of boiling water or ordinary steam, all foods may be successfully canned by the one time of processing just described. Micro-organisms cannot survive such a high temperature for any great length of time.

If, however, a hot-water or water-seal outfit is used, with which only the boiling temperature or a temperature slightly above that may be obtained, the results may be quite different from those with the steam pressure cooker. While tomatoes and fruits, because of their acid content, may be successfully canned in the hot-water outfit by the one time of processing just described, this is not always true for all foods, since micro-organisms may survive the temperature of boiling water for several hours. Although vegetables and meats *may* keep well when processed for a sufficiently long time for one day only, there is always an uncertainty about it, and the product of a whole week's work may be lost. The only safe and sure way for most vegetables and meats, if canned in hot water or ordinary water-seal outfits, is what is known as intermittent sterilization.

When this method is used, the food is processed for a given length of time (shown in the time-table in this lesson) on each of three successive days. Between the times of cooking, the food gradually cools, and this alternate heating and cooling favors the destruction of such micro-organisms as may have been able to resist one long time of cooking. Intermittent sterilization may not always be necessary, but it is always safe, and may often repay the canner for the extra time and trouble by insuring the result of his labors.

The cold-pack method of canning tomatoes in tin cans

1. Select tomatoes that are ripe but not over-ripe, free from blemishes, and of medium size if possible. They should be red to the stem end, since green parts cause a poor product. Imperfect tomatoes may be saved and used for making catsup and purée, or made into juice to be used in filling the spaces left in a can after it is packed with whole tomatoes.
2. Prepare the canning outfit — tables, chairs, utensils, fuel, fruit, water, salt, and sugar — ready for use.
3. Wash and scald the tin cans and caps, and begin the work of heating and tinning the capping and tipping steels.

To tin capping steels

- a) If the steel is very rusty, clean it with a piece of emery paper or a file.
- b) Heat the steel.
- c) Carefully dip the tip or end of the hot steel into a zinc-acid flux.

To make zinc-acid flux

- i. Pour into a glass jar or tumbler some hydrochloric acid (muriatic acid). (Hydrochloric acid may be procured at the drug store. It is a strong acid and must be handled carefully.)
- ii. Into this acid drop a few small chips of zinc (ordinary sheet zinc). Continue adding zinc chips piece by piece until no more will dissolve. There is a bubbling reaction between the acid and the zinc, and when the acid will dissolve no more zinc the bubbling ceases.
- iii. To the zinc-acid solution add an equal quantity of water. It is then ready for use. *This is a poisonous substance and should be so treated and labeled.*

- d) After the hot steel has been dipped into the zinc-acid flux, heat it again until it is red-hot, and dip the tip or end into a sal-ammoniac-solder flux.

To make sal-ammoniac-solder flux

- i. Cut solder into small chips.
- ii. Mix equal parts of dry sal ammoniac with solder chips in a box or other container.
- iii. Immerse the tip of the heated steel in this mixture.

The steel should now be well tinned and ready for use.

4. Wash the tomatoes thoroughly.

5. Scald the tomatoes by placing them in a wire basket or a cheesecloth bag and plunging them into boiling water for one fourth minute to three minutes, according to the ripeness and condition of the fruit. This is called *scalding*. If scalding is prolonged to five or more minutes of active boiling, as is necessary for some vegetables, it is called *blanching*.

6. Dip the scalded tomatoes at once into cold water. This is called the *cold dip*.

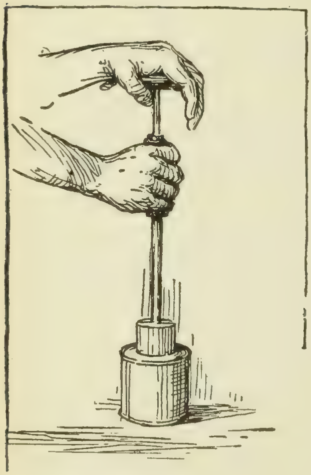
7. Remove the core or stem end of the tomato first, and then slip the skin off. Any juice that escapes should be saved for filling the cans.

8. Fill the tin can carefully, with whole tomatoes if possible, until the fruit comes to within one fourth inch of the top of the can. While filling, press the tomatoes close together with the bowl of a spoon.

9. Cover the closely packed tomatoes with tomato juice (not water) until the juice comes to within one fourth inch of the top of the can.

10. To each pint can of tomatoes add one half to one teaspoonful of salt and one half teaspoonful of sugar.

11. Solder the caps on the cans, invert on trays, and allow to drain through vent holes.



ADAPTED FROM GEORGIA STATE COLLEGE OF AGRICULTURE

FIG. 158.—*Capping a can with round capping steel*

To cap the cans

a) Have the capping iron well tinned and heated.

b) Wipe the top of the can clean and perfectly dry.

c) Put the cap in place, and with a small brush or mop apply the zinc-acid flux carefully to the solder hem of the cap, so as not to allow any flux to enter the can. *The flux is a poisonous substance, hence great care is necessary not to include any with the food.*

d) Hold the wooden handle of the capping iron in the right hand.

e) Hold the guide rod of the capping iron in the left hand, and rest its lower point in the small hole in the middle of the cap.

f) Lower the hot capping iron and let it rest squarely and firmly on the solder rim of the cap.

g) Revolve the iron on the cap, to melt the solder and seal the can. Use no pressure of the hand. The weight of the iron is sufficient, and more uniform results are obtained when pressure is not used.

h) Still holding the guide rod in place, raise the capping iron from the can. In a second or two, when the solder has hardened, remove the guide rod.

i) If the sealing seems to be irregular or imperfect, repeat the process. After a few attempts, practice will make perfect.

12. Weigh cans as required by the Pure Food and Drug Act.

13. Place the cans in a steamer or on a rack in a boiler, or according to directions given with the outfit in a commercial canner. When the boiler and rack are used, nearly cover the cans with water. Cover the boiler and bring the water to the boiling point. Boil for ten to fifteen minutes. This is called *exhausting*, and the time of exhausting should be long enough to allow the contents of the can to expand as much as is desirable before the can is sealed. The time should be counted after the water begins to boil, not when the cans are placed in the canner nor when the water is merely hot.

Note.— The exhaust period is not so necessary with tin cans as with glass jars, since tin may be strong enough to resist the pressure caused by the expanding contents of the can. Some canners tip the cans before sterilization, and thus save the time lost in removing the cans from the canner and returning them after tipping. It is safer, however, to exhaust before sealing.

14. Remove the cans from the canning outfit, and finish capping by closing the vent hole in the tin cap. This is called *tipping*.

To tip the cans

a) Dry the can top thoroughly. Apply a very light coating of zinc-acid flux to the small opening in the middle of the cap, *being very careful not to let any flux enter the can as the flux is a poisonous substance.*

b) Rest the heated tipping copper or iron above this small opening, hold against its tip the solder wire, and close the opening completely and neatly with melted solder, using the least possible bit of solder.

15. Return the cans to the canner. Boil for fifteen to thirty minutes, according to the condition of the tomatoes, the size of the can, and the kind of canner used. Time-tables showing time differences for various sizes of cans and for various fruits and vegetables are given in this lesson. This process is called *sterilizing*, *processing*, or *boiling*. (Read carefully the note on intermittent sterilization, page 1860, if any non-acid food is being canned.)

16. Remove the cans. Inspect them carefully in order to see whether all are air-tight.

17. After eight or ten days label the cans.

Labeling tin cans

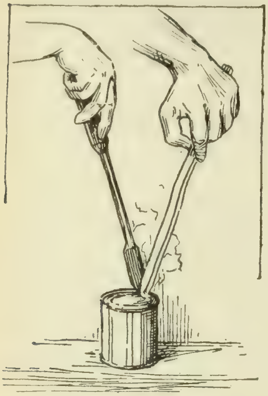
a) Label so that the sealed part of the can will be at the bottom.

b) Use a rather dry paste, and put it only on the end of the label, so that no paste need touch the tin.

c) If the paste is put on the can, it may rust the tin. Where a damp climate causes cans to rust easily, they should be lacquered before being labeled.

18. Grade and number the cans, and place them in tiers on shelves or pack them for shipment.

19. Enter in your notebooks the number of cans prepared, the cost of materials and time, and any other required data.



ADAPTED FROM GEORGIA STATE COLLEGE OF AGRICULTURE

FIG. 159.—*Tipping a can with soldering iron and solder*

The open-kettle method of canning tomatoes in glass jars

1. Select tomatoes that are ripe but not over-ripe, free from blemishes, and of medium size if possible. They should be red to the stem end, since green parts cause a poor product. Imperfect tomatoes may be saved and used for making catsup and purée, or made into juice to be used in filling the spaces left in a jar after it is packed with whole tomatoes.

2. Prepare the canning outfit — tables, chairs, utensils, fuel, fruit, water, salt, and sugar — ready for use.

3. Wash the glass jars and tops, place them in a kettle or other receptacle, cover with water, and boil for five to thirty minutes. Keep in boiling water until ready to use. Boil the rubbers one minute.

4. Wash the tomatoes thoroughly.

5. Scald the tomatoes by placing them in a wire basket or a cheesecloth bag and plunging them into boiling water for one fourth minute to three minutes, according to the ripeness and condition of the fruit. This is called *scalding*. If scalding is prolonged to five or more minutes of active boiling, as is necessary for some vegetables, it is called *blanching*.

6. Dip the scalded tomatoes at once into cold water. This is called the *cold dip*.

7. Remove the core or stem end of the tomato first, and then slip the skin off.

8. Cut the tomatoes into halves or quarters, and cook them in their own juice or in the least possible quantity of water for forty minutes or until tender.

9. Remove the jars from the boiling water, being careful not to permit any article to come in contact with the inside of the jars. Set the jars on a cloth in a pan of hot water.

10. Completely fill the hot sterile jars with the hot cooked tomatoes.

11. As each jar is filled, remove a rubber and a cover from boiling water, place them on the jar, adjust the clamp, and snap it into place, thus sealing the jar.

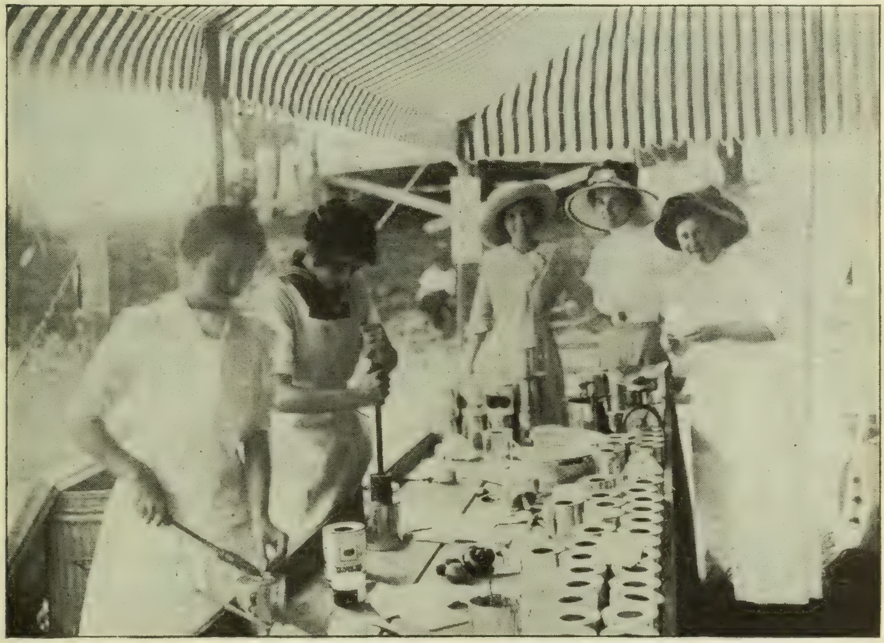


FIG. 160.—*Canning club tipping and capping cans*

12. Invert the jars on a cloth, and cover them in order to protect them from drafts and thus prevent cracking of the glass.

13. Test the jars after several days by loosening the clamp and picking up the jar by the edge of the glass cover. If the seal is perfect the cover will not come off. In that case snap the clamp back into place.

14. Label neatly, carefully, accurately, and according to specifications that will be furnished. Grade and number the jars, and place them in tiers on shelves or pack them for shipment.

15. Enter in your notebook the number of jars prepared, the cost of materials and time, and any other required data.

DEFINITIONS OF CANNING TERMS

The following definitions will enable the beginner to understand the ordinary terms used in canning:

Scalding.— To dip a fruit or a vegetable in boiling water in order (1) to remove the skin without loss of pulp, (2) to eliminate objectionable acids, and (3) to arrest flow of coloring matter.

Blanching.— To boil quickly in water for a brief time before the cooking process begins. This is best done by placing the vegetables in a cloth bag or a crate, which is to be lowered entirely under water. The purpose is (1) to eliminate acids and bitter substances from the fruit or vegetable. (2) to harden tissue, and (3) to set color. Vegetables softened and shrunken by blanching pack more closely in the jars than do those that have not been blanched.

Cold dip.— By this is meant the rapid cooling of the fruit or vegetable in cold water immediately after it has been scalded or blanched. The cold dip helps (1) to separate skin from pulp, (2) to set color bodies, and (3) to render packing easier.

Exhausting.— This is the name given to the process of cooking canned food in the cans for a few minutes before sealing the cans, in order to drive out of the fruit and the container all gases and surplus air and to permit expansion before sealing. If the tops of glass jars are clamped down before the air is driven out by the expanding liquid, the jars are likely to burst. Exhausting is not practiced by all canners, but the writers consider it important, and safer with the many kinds and qualities of fruit and vegetables canned, especially when using the hot-water bath outfits at home. Exhausting causes most fruit to shrink, but swells corn and some other vegetables.

Sterilizing.— To boil fruit or vegetables for a certain period after the container has been completely sealed. This is sometimes called *processing*, or *boiling*.

Processing.— (Used for *sterilization*, *cooking*, or *boiling*. These expressions may all mean the same thing.) To completely destroy all bacteria, spores, germs, and the like, in hermetically sealed cans and packages, by hot water, steam, or steam pressure.

Tinning the steel.— To put the hot steel used for capping cans into zinc-acid flux, reheat it, and then put it into sal ammoniac and solder, turning the steel several times until it is smooth and bright.

Capping.— To solder the little solder-hemmed tops on the cans with the capping steel.

Tipping.— To close or seal the little air hole or vent in the center of the tin cap, just between the exhaust and sterilization periods.

Flux.— Zinc-acid flux is prepared by adding to hydrochloric acid (muriatic acid) as much zinc as will be dissolved, and then adding water equal in amount to the acid. This fluid is used for cleaning the steel and for wiping all surfaces to be soldered. By the addition of zinc to the acid, zinc chloride is formed, and this when applied to the tin adds a coating of zinc, to which the solder will readily adhere. The flux should be applied carefully and none of it should be allowed to get inside the can. The solder will not adhere to tin without this flux or a similar substitute, such as rosin. A commercial flux can be procured at a drug store. Sal-ammoniac flux is made by mixing equal parts of dry sal ammoniac and chips of solder.

Cold pack.— By cold pack is meant the method of canning in which the can is filled with uncooked or blanched food, which is then sterilized in the can. This is in contrast to the old method of cooking food in an open kettle on top of the stove and then putting it into a can and sealing it.

Open kettle.— The open-kettle method of canning is the old method of cooking in an open kettle the food to be canned, and then pouring it into sterilized cans and sealing the cans. This method is not so safe as the cold-pack method, nor does it give as attractive results. It is the method that must be used, however, in making preserves, when concentration is necessary.

Other terms.— The meaning of the following terms may be found in a dictionary: bacteria, yeast, molds, spores, ferment, germs, microbes.

MISCELLANEOUS DIRECTIONS

To remove skins from peaches, plums, and pears

Bring to a boil nine gallons of water. Add one half of a ten-cent can of caustic potash, or concentrated lye, and one half ounce of alum. Lower the fruit into the boiling solution in a wire-basket container or a thin cloth. Let it remain for two minutes. Remove quickly, and immerse the fruit in cold water. Then wash the peeling from the fruit.

This process has been referred to the Board of Food and Drug Inspection, which reports that it will have no bad effect on the quality of the fruit and is not contrary to the requirements of the Food and Drugs Act.

To remove skins from tomatoes

Place the tomatoes in a steel crate, a wire basket, or a thin cloth. Lower into boiling water. Allow them to remain for one half minute to five minutes. Remove quickly, and immerse in cold water. With a small, sharp, paring knife, cut the stem core out first, and pull the skins from the tomatoes without removing the pulp. If the pulp adheres to the skin, the tomatoes have been boiled either too long or not long enough.

To remove skins from beets and carrots

The same process used for tomatoes can be used in the removal of skins of beets or carrots, except that the length of time of scalding may need to be longer than for tomatoes.

Sirups

Almost all sirups are made after what is known as the California formula, one and one half pint of sugar to one pint of water boiled to a sirup. The following degrees of concentration[1] are indicated in canning and preserving:

Thin sirup.— Mix water and sugar, and heat the solution to the boiling point. This gives a sirup of 18° to 20° concentration, such as might be used with canned apples.

Medium thin sirup.— Mix water and sugar, and boil until the solution begins to be sirupy. This gives a sirup of 22° to 32° concentration, such as might be used with blackberries.

Medium thick sirup.— Mix water and sugar, and boil until the solution will hang from a spoon. This gives a sirup of 32° to 40° concentration, to be used, for example, with strawberries.

Thick sirup.— Mix water and sugar, and boil until the solution forms a very soft ball under water. This gives a sirup of 42° concentration and over, and may be used with sun-preserved strawberries.

One and one half quart of sugar and one quart of water will yield the following amounts of sirup:

Thin sirup — a little more than 3½ pints.
Medium thin sirup — a little more than 3 pints.
Medium thick sirup — a little more than 2½ pints.
Thick sirup — about 2 pints.

Time-table for blanching

Unless prepared by the open-kettle method, all vegetables and most fruits need to be blanched before being packed in the jars. After blanching, plunge into cold water and pack quickly.

1. Blanch peas, beans, and the like, for five to ten minutes.
2. Blanch corn on the cob for five to fifteen minutes.
3. Blanch pumpkin, squash, and mangoes for about five minutes.
4. Blanch okra, cabbage, and sweet potatoes for five minutes.
5. Blanch asparagus for five to ten minutes.
6. Blanch greens for ten minutes or more.
7. Blanch rhubarb, beet tops, and the like, for one to three minutes.
8. Blanch or scald beets, carrots, turnips, and the like, for six to ten minutes.

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[1] By "degrees of concentration" is meant the relative density of a sirup; this is measured by a sirup gauge.

9. Scald tomatoes, plums, pears, and the like, for one to two minutes.

10. Scald peaches and apricots for one to two minutes.

11. Blanch cabbage, chard, and like vegetables, for about twenty minutes before packing, in order to reduce bulk.

Time-table for canning food with one period of sterilization

(To be followed in the use of the four different types of portable home canners. For altitudes of 4000 feet or more above sea level, add about twenty or twenty-five per cent more time to this schedule.)

	Size of cans. No. 3 contains one quart; No. 2 contains one pint	Time of cooking (minutes)			
		Hot-water bath outfits, at 212°	Water-seal outfits, above 212°	Steam-pressure cooker, five pounds or more	Pressure cooker, ten pounds or more
Apples	3	15	13	10	6
Apricots	3	15	12	10	6
Asparagus (greens)	2 or 3	60	60	40	30
Apple cider	2 or 3	20	15	12	10
Beans (Lima and string)	2 or 3	90	60	60	30
Blackberries, dewberries	2 or 3	8	8	6	3
Cherries, peaches	2	15	12	10	5
Corn without acids	2	240	180	90	60
Grapes, pears, plums	2	15	15	10	6
Hominy	3	60	50	40	35
Huckleberries	2	15	12	8	5
Okra	2 or 3	60	60	40	30
Okra and tomatoes combined	2 or 3	50	50	40	30
Oysters	1	50	50	40	30
Peas (field)	2	60	60	40	30
Peas (garden or English)	2	240	180	90	60
Pineapple	2 or 3	30	25	10	10
Raspberries	2 or 3	15	12	8	5
Sauerkraut	3	50	50	40	25
Sausage	2	60	60	40	35
Sweet potatoes	3	80	70	60	40
Strawberries	3	20	15	10	5
Succotash	2 or 3	60	60	40	30
Tomatoes	2 or 3	22	20	10	6
Tomatoes and corn	2	80	70	60	40
Grape juice	2	15	15	10	5
Quince	3	30	25	15	10
Tomato juice	2	20	20	15	10
Pumpkin	3	50	50	40	30
Fish, pork	2	200	200	120	60
Chicken, beef	3	250	240	180	40
Figs	3	30	20	10	5
Squash	3	50	40	30	20
Spinach	3	60–90	60–90	40–60	30–40
Other greens	3	90	90	60	40
Rhubarb	3	25	25	15	10
Beets	3	90	75	60	40

Time-table for canning food with intermittent sterilization

Food	Special preparation before canning	Time of cooking (minutes)		
		Before sealing	After sealing	Second and third days
Asparagus	Cut in lengths to fit jar. Blanch 5 minutes, and drain.	15	45	60
Beets	Blanch until skin is easily removed. Can whole, in slices, or in quarters	15	45	60
Beans, Lima	Hull by hand. Blanch 5 minutes	15	45	60
Beans, string	Remove strings, cut into 1-inch pieces. Blanch 5 minutes and drain before putting into cans	15	45	60
Corn	Blanch 5 to 15 minutes on the cob. Cut grains from cob and scrape cob, or score grains before cutting from the cob	15	45	60
Eggplant	Cut in thin slices, drop in boiling water, and let stand 15 to 20 minutes. Drain and pack in jar	15	45	60
Peas	Shell. Blanch 5 minutes. Remove wrinkled peas. Put into cans	15	45	60
Pumpkin	Peel, cut into small blocks. Blanch 5 minutes	15	45	60
Spinach	Wash free from all sand and grit. Remove discolored leaves. Blanch 20 minutes. Drain and pack in jars	10	30	40
Succotash Corn $\frac{2}{3}$ Beans $\frac{1}{3}$	Prepare corn and beans as directed	15	45	75
Sweet potatoes	Boil until skins will peel off. Cut in convenient sizes to fit cans	15	45	60
Tomatoes	Scald for 1 to 5 minutes. Remove skins. Save any juice escaping	10	20	30
Tomato mixture Corn $\frac{1}{3}$ Tomatoes $\frac{2}{3}$	Prepare each as directed above and mix	15	45	60

CANNING RECIPES FROM UNITED STATES DEPARTMENT OF AGRICULTURE

If possible, master the canning of tomatoes first, then proceed with other vegetables and fruits, one at a time.

Tomatoes

Grade and sort the tomatoes according to ripeness, size, and quality. Scald, in order to loosen skin. Dip into cold water. Remove core and skin. Carefully pack whole tomatoes in cans. Fill spaces in cans of tomatoes with tomato juice only, and add one level teaspoonful of salt to each quart can. Place rubber and top on glass cans and close loosely, but do not clamp. If tin cans have been used, cap and tip tins. Exhaust for five to eight minutes. Sterilize for about twenty-two minutes in hot water, or twenty minutes in water-seal outfit, or ten minutes under five pounds of steam, or six minutes in pressure cooker. Remove jars, tighten clamp covers, and invert to cool.

Strawberries

(1) Can fresh, sound berries on the same day that they are picked. Hull by twisting berries off the hull. Place berries in strainer, cleanse by pouring water over berries. Pack closely in jar or tin without crushing. Pour hot sirup over berries to fill can. Place rubber and top on glass can and close loosely. (Cap and tip tin cans.) Sterilize for twenty minutes in hot-water bath, or fifteen minutes in water-seal outfit, or ten minutes under five pounds of steam, or five minutes in pressure cooker. Use medium thick sirup.

(2) Same as above except sirup. Instead of sirup made with sugar, use a sirup made as follows: Crush enough berries to obtain one quart of natural juice; add one quart of sugar; boil until medium thick. Add to cans filled with berries, and proceed as directed under (1).

(3) Sun preserves. Choose ripe, firm berries. Pick and preserve on the same day. Hull and rinse berries as directed under (1). Place in shallow platter in single layer. Sprinkle sugar over berries. Pour over them 40° sirup (same as given under (1), boiled thicker). Cover with a glass dish or a windowpane. Allow to cook in hot sun for six to ten hours. Pack in glasses, jars, or cups. Cover with paraffin or sealing wax. Tie paper over tops. Keep in a cool, dry place.

Carrots, parsnips, sweet potatoes, and the like

Scald for one to five minutes in boiling water. Plunge into cold water. Remove skin. Pack in cans whole or in slices. Fill spaces in cans with boiling water, and add one level teaspoonful of salt to each quart can. Adjust rubber and top on glass can, and close loosely but do not clamp. (Cap and tip tin cans.) Exhaust for fifteen minutes and seal. Sterilize for one and one half hour in hot-water bath, or one hour and fifteen minutes in water-seal outfit, or one hour under five pounds of steam, or forty minutes in pressure cooker. Intermittent sterilization is safest for these vegetables if the water-bath canner is used. In that case sterilize for sixty minutes on each of three days.

Eggplant

Scald for five minutes in boiling water, salted. Plunge into cold water. Remove skin. Slice crosswise and pack. Fill spaces in can with boiling water, and add one level teaspoonful of salt to each pint can. Adjust rubber and top on glass can and close loosely. (Cap and tip tin cans.) Exhaust for fifteen minutes and seal. Sterilize for one hour in hot-water bath, or fifty minutes in water-seal outfit, or forty-five minutes under steam pressure, or thirty minutes in pressure cooker. Intermittent sterilization is safest for these vegetables if the water-bath canner is used. In that case sterilize for sixty minutes on each of three days. Remove jars, tighten covers, and invert to cool.

Sweet corn on the cob

Blanch in boiling water for ten to fifteen minutes, according to ripeness, size, and freshness. Plunge into cold water. Pack in cans, alternating butts and tips. Add a very small quantity of boiling water, but do not fill can with water, and add one level teaspoonful of salt to each quart can. Adjust rubber and top on glass can and close loosely. (Cap and tip tin cans.) Exhaust for fifteen minutes and seal. Sterilize for four hours in hot-water bath, or three hours in water-seal outfit, or one and one half hour under five pounds of steam, or one hour in pressure cooker. Remove jars, tighten covers, and invert to cool.

Sweet corn off the cob

Prepare as described above, but cut corn from cob after blanching. Pack compactly, and fill spaces in jars with boiling water, adding one level teaspoonful of salt to each pint can. Process as directed above.

Peas, beans, asparagus tips, and the like

Blanch for five to ten minutes in boiling water. Plunge into cold water. Pack, and fill spaces with boiling water, adding one level teaspoonful of salt to each pint can. Adjust rubber and top on glass can and close loosely. (Cap and tip tin cans.) Sterilize for three to four hours in hot-water bath, or three hours in water-seal outfit, or one and one half hour under five pounds of steam, or forty minutes in pressure cooker. Intermittent sterilization is safest for these vegetables if the water-bath canner is used. In that case sterilize for sixty minutes on each of three days.

Swiss chard, beets, turnips, and the like

Scald for one to six minutes in boiling water. Plunge into cold water. Remove skin. Slice and pack in cans. Add boiling water to fill spaces in cans, and add one level teaspoonful of salt to each pint can. Adjust rubber and top on glass can and close loosely. (Cap and tip tin cans.) Sterilize for one and one half hour in hot-water bath, or one and one fourth hour in water-seal outfit, or one hour under five pounds of steam, or forty minutes in pressure cooker. Intermittent sterilization is safest for these vegetables if the water-bath canner is used. In that case sterilize for sixty minutes on each of three days. Remove jars, tighten covers, and invert to cool.

Greens, spinach, dandelion, mustard, beet tops, and the like

Blanch in boiling water for ten minutes. Plunge into cold water. Cut ready for table use. Pack closely, filling the jar nearly full, add water to fill spaces in cans, and add one teaspoonful of salt to each quart can. Adjust rubber and top on glass can and close loosely. (Cap and tip tin cans.) Sterilize for one hour and thirty minutes in hot-water bath or water-seal outfit, or forty minutes under five pounds of steam, or thirty minutes in pressure cooker under ten or more pounds of steam. Intermittent sterilization is safest for these vegetables if the water-bath canner is used. In that case sterilize for sixty minutes on each of three days. Remove jars, tighten covers, and invert to cool.

Windfall apples

(*Note.*— For canning whole apples, choose firm, not over-ripe, apples. A great difference in the canned products will be noted in the different varieties of apples. The recipe below is intended for firm, and preferably tart, varieties. Some varieties will require less time, and some more, than is here indicated. Experience will teach adjustment of time.)

Remove blemishes, cut out core. Blanch for five minutes in boiling water. Plunge into cold water. Pack in tin cans or glass jars, and add very thin sirup to fill spaces in the can. Adjust rubber and top on glass can and close loosely. (Cap and tip tin cans.) Sterilize for fifteen minutes in hot-water bath, or thirteen minutes in water-seal outfit, or ten minutes under steam pressure, or six minutes in pressure cooker. Remove jars, tighten covers, and invert to cool.

If the apples are canned in this way, enormous waste will be eliminated and the product will be available for apple salads, dumplings, breakfast apple dishes, and the like.

Windfall apples for pie filling

Peel, core, and slice apples. Scald for two minutes in boiling water. Plunge in cold water. Pack in glass or tin cans, and add about one teacupful of hot, thin sirup to each quart can. Adjust rubber and top on glass can and close loosely. (Cap and tip tin cans.) Sterilize for sixteen minutes in hot-water bath, or twelve minutes in water-seal outfit, or ten minutes under five pounds of steam, or four minutes in pressure cooker. Remove jars, tighten covers, and invert to cool.

The fact that the can is not filled with liquid in no way interferes with the keeping quality of apples canned in this manner.

USES OF PRESERVATIVES[2]

" The attention of the Department of Agriculture has recently been called to the widespread use, especially in rural communities, of salicylic acid in putting up preserves. The head of a large drug and chemical supply house states that people living in southwest Virginia, North and South Carolina, Kentucky, Tennessee, and western Georgia, have been purchasing salicylic acid in quarter-pound packages for a number of years and that this practice has grown to an enormous extent. This dealer states further that only a few weeks ago he received an order from one wholesale grocer for fifty gross of these goods.

" The Department is aware that this practice is not confined to salicylic acid under its own name alone, but that large quantities of this acid, and of boric acid as well, are sold under fanciful names as preserving powders or canning compounds at prices which are much in excess of their real value.

" In the directions for use, the housewife is told to fill the jar with the fruit or vegetables, cover with water, and add a teaspoonful of the powder. It is true that these powders may prevent the decay of the fruit or vegetable, but they also encourage uncleanly or careless work, and their excessive use may be attended with very serious effects upon the health. Salicylic acid is a medicine of the greatest value in acute articular rheumatism and certain other diseases. It is well known as a poisonous substance, and one of the evils which may accompany its use is derangement of the digestion. It is therefore plain that its extensive use in food may lead to disturbance of digestion and of health.

" It is entirely practicable to put up both fruits and vegetables in such a manner that they will keep indefinitely by sterilizing the products by means of heat, and there is no excuse for running any risk by the using of preserving powders."

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[2] Quoted from press notice sent out by United States Department of Agriculture.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE
NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
Entered as second-class matter at the post office at Ithaca, New York

B. T. GALLOWAY, *Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 69 AUGUST 1, 1914 CANNING CLUB SERIES No. 2

CANNING CLUBS IN NEW YORK STATE.—PART II PRINCIPLES AND METHODS OF CANNING

DISCUSSION PAPER

Each club member, in order to be eligible to the use of the canning club label, must give a description of her canning experiments by answering the questions on the discussion paper. We shall be glad to have others answer the questions who have tried canning as a business venture. Write on a separate sheet all information for which there is not space here. Photographs will add greatly to your paper if you have been able to get them. Send to the Department of Home Economics, New York State College of Agriculture, Ithaca, New York.

1. What products have you canned this year?

2. What have you learned by experience in canning this year?

3. Have your canned products spoiled? If so, why?

4. How have you marketed your canned goods?

5. Have you kept a record of your expenses and profits?

Name...

Address...

Date..

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VOL. III. No. 71 SEPTEMBER 1, 1914 **CANNING CLUB SERIES No. 3**

CANNING CLUBS IN NEW YORK STATE.—PART III
CANNING EQUIPMENT

O. H. BENSON AND FLORA ROSE

It is a lamentable fact that not only has more than fifty per cent of the natural product of the average orchard and garden been wasted, but, for want of some simple way of taking care of surplus products, food is actually lost to American homes. It is therefore a part of our national problem to find means of preventing such waste. To that end canning clubs are being organized and developed in the rural districts of many States.

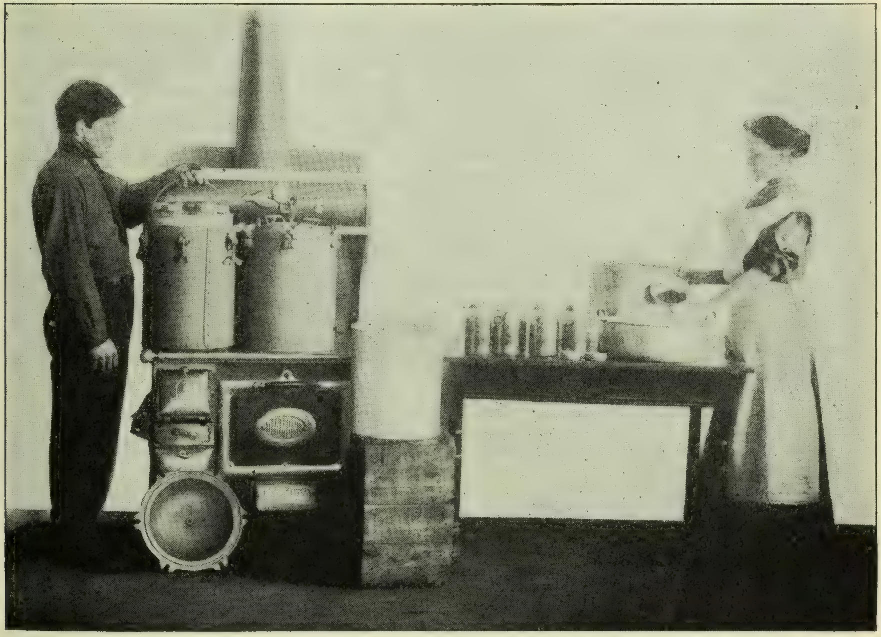

FIG. 161.—*A canning outfit in operation*

If canning is to be done successfully, even on a small scale, it is necessary to have some equipment that will lighten labor and save time. Such equipment may be bought especially for the purpose, or it may be made from something already on hand.

The first and most essential part of the canning equipment is a receptacle in which the cans or jars of food to be preserved may be steamed or boiled. This receptacle and its parts are generally spoken of as the canner, or the canning outfit.

Every well-regulated farm should have a home canner of some description. It is quite as important as the milk separator, the fanning mill, or the corn harvester, and it is possible to make your own device, as suggested in this lesson. Every child should be taught the art of canning, either at home or in the canning club.

The possession of a portable canner encourages more and better canning at home, since all the members of the family take an interest in the work and offer their assistance; the work may be done out of doors — an arrangement that relieves the busy housewife from cleaning up at the close of each canning experience, and gives the operators fresh air and the freedom necessary for good work instead of the heat and confinement of the kitchen. The purpose of this series of lessons is to show how easy it is to save the surplus product, to encourage more gardening, and to make it easy to can a large quantity of fruits and vegetables for both home and market use. Most women and girls need the "pin money" made possible by this canning work. During the last few years manufacturers have foreseen this need, and have developed many kinds of canning outfits that may be used in the home, on the farm, and in the school, and that answer every purpose of a factory canner. These range in price from $5 to $75. A book of instruction accompanies each outfit, and with these directions and the suggestions contained in the canning club lessons a failure in canning will be unlikely.

Commercial canning outfits are divided into two general classes:

1. *The factory equipment*, constructed in many different sizes, designed for stationary work in factories and for handling large quantities of products within a very short period of time. Consideration of this type is not of importance to the home canner.

2. *The portable, or home, canning outfits*, constructed so as to make them convenient for the work of canning the surplus products of orchard and garden, of the country or the village home.

KINDS OF PORTABLE CANNERS SUITABLE FOR CLUB USE

Hot-water outfit

The simplest type of canner is the hot-water outfit. In this, the cans are surrounded by boiling water or ordinary steam, and the food to be canned is thus cooked at the temperature of boiling water. Any utensil which has a false bottom or rack for lifting the cans above the bottom of the receptacle, which is large enough to hold a number of cans, and which is deep enough to allow the cans to be completely covered with water — or, if the receptacle is a covered one, with steam — may be used as a hot-water canner. Receptacles with close-fitting covers are best for this purpose, however, since in such receptacles the cans need not be completely covered with water but the contents may cook in the steam that is produced by the water and held around the cans by the cover.

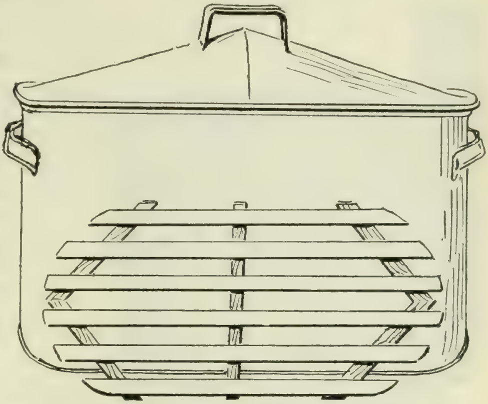

FIG. 162.—*The clothes boiler used as a sterilizer, showing false bottom as a rack*

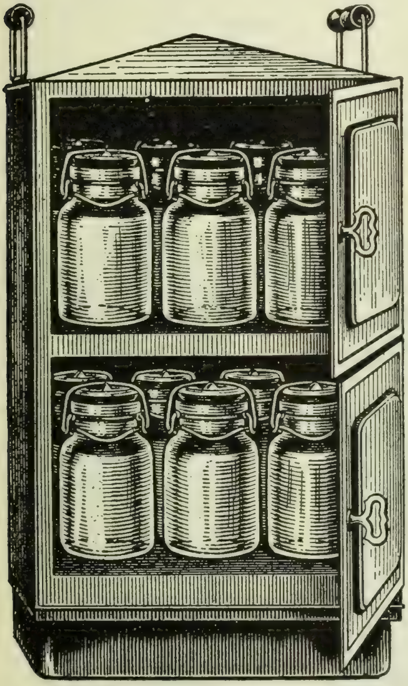

FIG. 163.—*Steam cooker*

Homemade hot-water outfits

The clothes boiler, with a false bottom made of slatted wood or wire gauze, makes an excellent canner, since it is deep, large, and conveniently handled.

The steam cooker is a great convenience in canning.

A large covered pail with a wooden rack may be used in canning, but it is not so well adapted for that purpose as the boiler because of its limited capacity.

A large metal tub is fairly good if a boiler is not available. It is not the best receptacle to use, however, because it cannot be covered and hence the cans must be completely covered with water in order to insure their thorough cooking.

Commercial hot-water outfits

A number of simple hot-water outfits are now on the market. The main advantages that these have over those adapted at home from some other equipment are that they will hold more cans at one time, and that they have perforated trays, with handles, on which cans may be placed and a number of cans may thus be lowered into and lifted from the canner at one time. Such trays may and should be made for the homemade outfit.

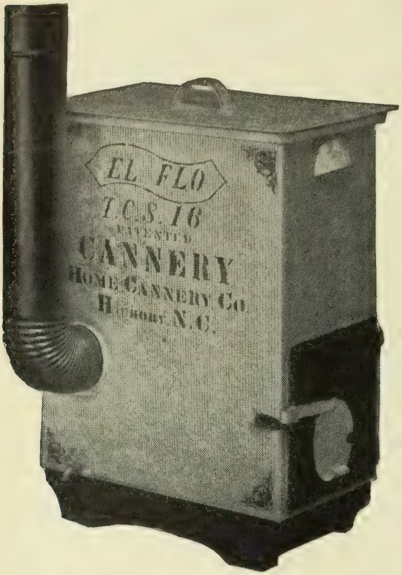

FIG. 164.—*Commercial hot-water canning outfit, made for out-of-door and club work*

Need of intermittent sterilization when hot-water outfits are used

No matter what type of hot-water outfit is employed, if results are to be absolutely certain when meat and many non-acid vegetables are canned, the intermittent process of sterilization is safest to use. This necessitates cooking the food in the cans for a given time on each of three successive days. The labor and cost of operation is greater than with an outfit in which a temperature may be secured that is sufficiently high to sterilize the food in one period of cooking.

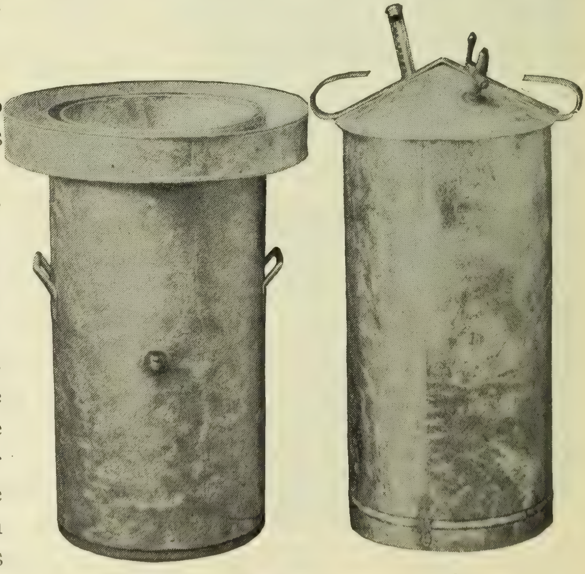

FIG. 165.— *Water-seal canning outfit*

Water-seal outfit

Next in simplicity to the hot-water outfit is the water-seal outfit. The main difference between this and the hot-water type is that the cover of the water-seal outfit is so devised that a seal of water holds it down tight, and thus the steam in the space above the cans is held under slight pressure. The temperature of steam under pressure rises above that of boiling water. Hence in the water-seal outfit a temperature somewhat above that of boiling water may be obtained, and thus the time needed for sterilization may be somewhat reduced. The efficiency of such an outfit depends on the amount of pressure produced.

Steam pressure canners

When steam is held under considerable pressure, temperatures much higher than that of boiling water may be obtained, and the rise in temperature depends on the rise in pressure. A number of good portable canners in which a pressure of five to fifteen pounds may be obtained are now on the market.

Steam pressure canners are the most successful for canning all kinds of vegetables and meats, because the greater heat obtained in them effects complete sterilization in a comparatively short time. Steam under fifteen pounds pressure readily and rapidly destroys all bacteria and spores in fruit, vegetables, and meat. When steam pressure canners are used, not only is the total time of cooking much reduced, but also only one period of cooking is needed in order to insure the keeping of all canned foods, and hence time, labor, and heat are saved. Five to fifteen pounds pressure to the square inch is used in successful canning. As the pressure increases, the temperature of the steam increases and the time required for sterilization decreases.

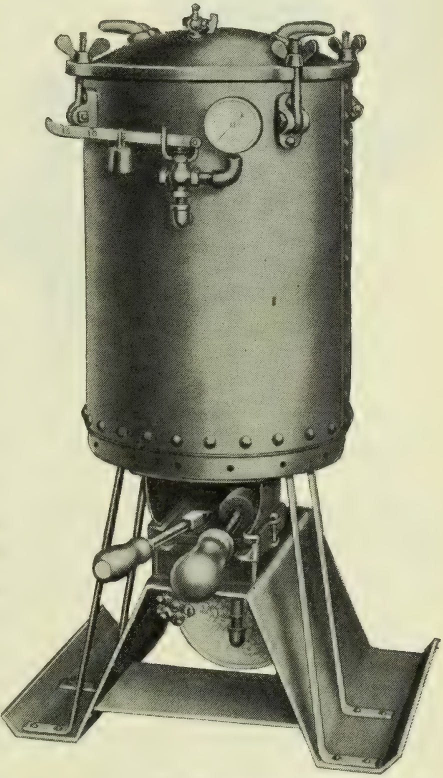

FIG. 166. — *Steam pressure canner, with soldering outfit*

Choose the outfit that seems to meet your needs. If possible, see it in operation before buying.

JARS AND CANS

Glass jars

There are many kinds of fruit jars on the market. The question is frequently asked, "Which jar is the best to choose?" The answer is, choose the jar which is simplest in construction, which will seal perfectly and wash easily, which protects the contained food against contact with metals, which has the fewest parts to lose or misplace, and which fits the shelves and receptacles planned to hold it. The type of can that seems to give the most general satisfaction is one having a glass cover clamped on with some metal device. For home canning almost any good glass jar gives good results. For commercial purposes the greatest care must be taken in the selection of a jar with a cover that will seal perfectly; otherwise, when fruit is shipped the cover will slip a little and the jar will leak, and in many cases the food will spoil.

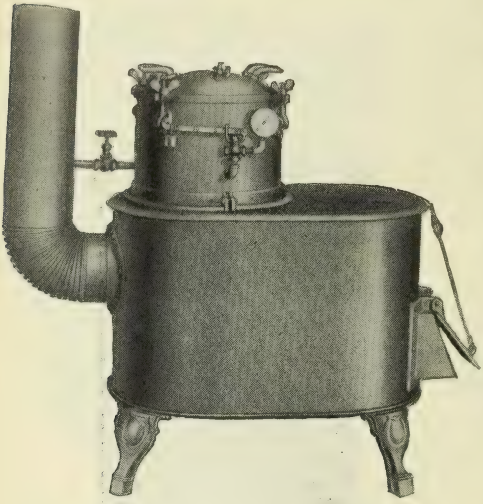

FIG. 167.—*Steam-pressure canner with firebox. For canning in medium small quantities, either inside or outside the house*

To test a jar.—Before using a glass jar for canning food, it should be tested. The testing is accomplished by partly filling the jar with water, adjusting cover and rubber, sealing, and inverting the jar. If it leaks, examine it to find whether the leakage is owing to an imperfect jar or to a poor rubber. If the jar is imperfect, reserve it for home use in canning pickles or some food that does not require sealing.

Rubbers for glass jars.—Use new can-rubbers with each year's product of canned food. Old rubber loses its elasticity, and its use may cause imperfect sealing and thus endanger the keeping quality of the food. Care should be given to the selection of good rubber, for even new rubbers may be stiff, inelastic, and hard, and may contain no rubber at all. Good rubbers are hard to procure, but nothing less than the best should be accepted.

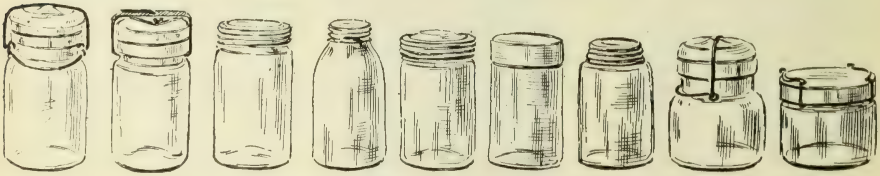

FIG. 168.— *Types of glass jars for home use*

They are more expensive than the poor rubbers, but in the long run they cost less.

Tin cans

Select only a good grade of heavy tin cans, with solder-hemmed caps. Wide-mouthed cans are more convenient for filling than those with very small openings.

EQUIPMENT OF THE CANNER

The various types of home canners should have the following equipment, in order to be complete and ready for use without additional purchases:

Equipment for hot-water outfits, homemade or commercial

- A boiler to contain water and hold cans
- A lattice bottom of wood, or a screen for the boiler or sterilizer (if made at home)
- Inside crates or blanching trays, for lifting a number of cans or a quantity of food at one time into or out of the boiler
- A pair of tray lifters
- A fire box, a stove, or some type of fire provision
- A smoke pipe to fit the equipment
- A fruit filler

Equipment for steam-pressure outfits

The equipment is the same as for hot-water outfits, with the addition of a steam gauge, a pet cock, and a thermometer. In some cases when canning is done in tin cans, a blast furnace is supplied, together with the soldering tools. Some outfits include a boiler, a crate, a soldering outfit, and arrangements for a fire pot.

Outfits similar to those described and illustrated are on the market for club work and cost $5 to $75. An instruction book is usually furnished with each outfit, giving simple rules for its use and a table for the exhausting and processing of the various kinds of fruits and vegetables. (An explanation of the terms "exhausting" and "processing" will be found on page 276 of Lesson 69 of this Reading-Course.) A valuable feature of the portable canning outfit lies in the fact that it is as easily handled by children as by adults, and can be used out of doors in the orchard, the garden, or the back yard, thus relieving the housewife of a considerable part of the cleaning-up incident to a day's work in canning.

If tin cans are to be used, the following additional articles will be needed:

- One or two circular capping steels. A self-heating capping steel is now on the market, which saves much labor

A funnel for filling gasoline reservoir, of self-heating capping steel
A tipping copper
A pair of can lifters
A sponge
A small brush
A wood or coal grate for the fire pot, and an ash rake
A file, and some emery cloth or paper
An asbestos mat, and a tin pan for resting capping iron on
Solder wire, sal ammoniac, hydrochloric acid (muriatic acid), and zinc chips for making flux and for closing cans
A pint or half-pint jar to contain flux for cans
A quart cup to hold flux while tinning the steel
A table about 3 x 3 feet in size, zinc-covered if possible

UTENSILS FOR PREPARING AND COOKING MATERIALS

One or more large granite or aluminum preserving kettles

A wire basket or a large square of cheesecloth, for holding fruits or vegetables that are to be blanched

A wire sieve and a colander

A quart cup, a half-pint cup, two teaspoons, and a tablespoon, for measuring

Several paring knives and a large knife

A large wooden spoon for stirring

A can funnel and a bottle funnel

A wooden chopping bowl

A good-sized worktable

Some white oilcloth for covering table

Stools and chairs

A clock in a convenient position where all can see it

Scales graduated from one ounce to twenty-four pounds

A record book in which all records are kept for the use of the club member, the school, or the housewife. If pupils constitute a class, each pupil should have a record book and a pencil

Plenty of clean wiping cloths

Salt, sugar, and plenty of clean, pure water

A sharp paring knife for each person working

Tables, tins, pans, containers, buckets, large spoons, vegetable brushes, quart measures, pitchers, enough for convenient and efficient work

The necessary glass jars, with a sufficient number of the best rubbers on the market. A good rubber is elastic, not brittle; it will not break easily when stretched with the fingers. If the canning is done in tin, a supply of tin cans with solder-hemmed caps is needed, together with some soldering flux, either commercial or homemade

MANAGER OF WORK

Last, but not least, there must be a leader, or manager, of the canning party, in case the work is done from the standpoint of the school or the class in canning. This leader should have the program well in hand, so as to arrange for the proper division of labor and at the same time permit every member to make his or her experience complete, from the preparation of the fruit and the sterilization of utensils to the labeling of the can or jar.

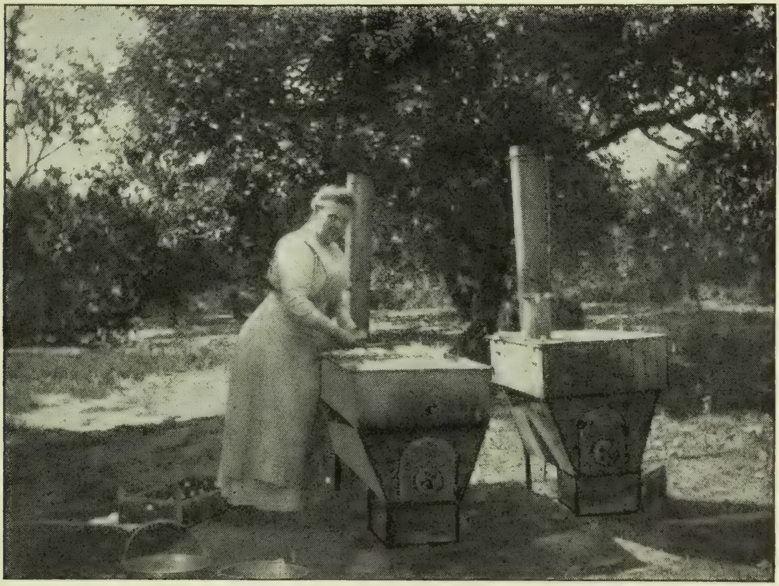

FIG. 169.— *Operator at work in the orchard*

MANUFACTURERS OF HOME-CANNER OUTFITS AND SUPPLIES, SUGGESTED BY THE UNITED STATES DEPARTMENT OF AGRICULTURE

Northwestern Steel & Iron Works, Eau Claire, Wisconsin.
  Steam-pressure canners, many sizes.
The West Manufacturing Company, 372 Bullitt Building, Philadelphia.
  Hot-water canners, water-seal outfits, and other supplies.
Home Canner Company, Hickory, North Carolina.
  Hot-water and steam canners, cans, and all supplies.

F. S. Stahl Canner Company, Quincy, Illinois.
Canning outfits, cans, supplies, etc.

Modern Canner Manufacturing Company, Chattanooga, Tennessee.
Home canners, cans, etc.

Griffith & Turner Company, 205–215 North Paca Street, Baltimore, Maryland.
Implements, canning outfits, cans, and supplies.

A. K. Robins & Co., 116 Market Place, Baltimore, Maryland.
Canning machinery, large and small canning equipment.

Farm Canning Machine Company, Meridian, Mississippi.
Hot-water canners, cans, labels, etc.

The Raney Canner Company, Chapel Hill, North Carolina. Also Texarkana, Arkansas-Texas.
Hot-water canners, cans, and labels.

The Royal Canner Company, Chattanooga, Tennessee.
Canning outfits, cans, and supplies.

E. F. Kirwan & Co., Baltimore, Maryland.
Hot-water canners and cans.

Hazel-Atlas Glass Company, Wheeling, West Virginia.
E-Z seal jars, bottles, tumblers, etc.

The Southern Evaporator Company, Chattanooga, Tennessee.
Canning outfits, cans, supplies, etc.

American Can Company, Cleveland (Ohio), New York, Philadelphia (Pennsylvania), Chicago (Illinois), etc.
Cans, all sizes.

REFERENCES FOR CLUB STUDY

Every club member should read and study the following Lessons of the Reading-Course for the Farm Home, and the following Farmers' Bulletins of the United States Department of Agriculture.

The Reading-Course Lessons may be obtained free of charge by writing to the Department of Home Economics, New York State College of Agriculture, Ithaca, New York:

No. 13 Cornell study clubs. By Martha Van Rensselaer
No. 15 Principles of jelly-making. By N. E. Goldthwaite
No. 17 The preservation of food in the home.— Part I. By Flora Rose
No 19 The preservation of food in the home.— Part II. By Flora Rose
No. 21 The preservation of food in the home.— Part III. By Flora Rose and others
No. 31 Household bacteriology. By Martha Van Rensselaer
No. 33 Vegetable gardening. By Albert E. Wilkinson

No. 47 A canning business for the farm home. By Claribel Nye and Bessie Earll Austin

The Farmers' Bulletins may be obtained by writing to the Division of Publications, United States Department of Agriculture, Washington, D. C.:

No. 203 Canned fruits, preserves, and jellies

No. 426 Canning peaches on the farm

No. 521 Canning tomatoes at home and in club work, containing special canning instructions for club work and canning

The following bulletins will also be found helpful:

The home canning of fruits and vegetables. North Carolina Department of Agriculture, vol. XXI, no. 5, May, 1910

Practical directions for preserving native fruits and vegetables. University of Wisconsin, Bulletin No. 136, April, 1906

Study of the methods of canning meats. Bureau of Animal Industry, United States Department of Agriculture, Bulletin —, 1907

Fruits and fruit products. United States Bureau of Chemistry, Bulletin 66

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SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

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B. T. GALLOWAY, *Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM HOME, MARTHA VAN RENSSELAER, Supervisor

VOL. III. No. 71 SEPTEMBER 1, 1914 **CANNING CLUB SERIES No. 3**

CANNING CLUBS IN NEW YORK STATE.—PART III
CANNING EQUIPMENT

DISCUSSION PAPER

Each club member, in order to be eligible to the use of the canning club label, must give a description of her canning experiments by answering the questions on the discussion paper. We shall be glad to have others answer the questions who have tried canning as a business venture. Write on a separate sheet all information for which there is not space here. Photographs will add greatly to your paper if you have been able to get them. Send to the Department of Home Economics, New York State College of Agriculture, Ithaca, New York.

1. Have you used a pressure canner? What were the results?

2. What type of hot-water outfit have you used? Wherein does it fail to meet your needs?

3. With what type of jars are you most successful?

4. Do you have any difficulty in getting good can rubbers?

5. Have you had experience in canning in tin? If so, what was the result?

Name..

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VOL. III. No. 50 OCTOBER 15, 1913 **THE SOIL SERIES No. 3**

NATURE, EFFECTS, AND MAINTENANCE OF HUMUS IN THE SOIL

ELMER O. FIPPIN

In the mind of the experienced farmer, a dark color of the soil is usually associated with a higher degree of productiveness than is a light color. This dark color is known to be due usually to partially decayed organic matter — plant and animal material — which is termed humus. The close relation between the dark color, which is usually some shade of gray, brown, or black, and the large productiveness of a soil is so general that many persons judge the fertility of a soil by the depth of these shades. It is well understood that the gradual loss of color in soil under cultivation is associated with a decrease in the productiveness of the land. This is the most evident change in the process of soil exhaustion and the one by which crop yields gradually decrease until they cease to pay the cost of working the land. Many large areas of soil in different parts of the world have been exhausted in that this dark color has disappeared. Very often, the decrease in productiveness and the loss of color are due almost

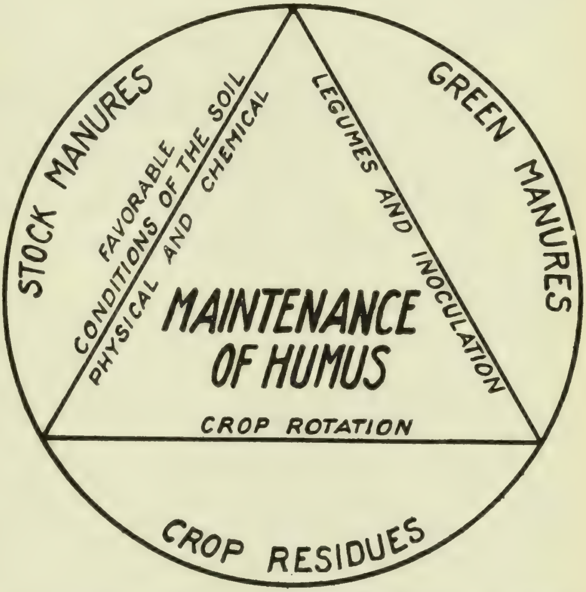

FIG. 1.—*Diagram representing the means by which the supply of humus is maintained in the soil*

entirely to the exhaustion of the stock of humus. As a result of the elimination of humus and its beneficial effects on the properties of a soil, the exhaustion of other plant-food materials is apparent. The maintenance of humus, therefore, is one of the most important and most fundamental factors in a system of good soil management.

THE NATURE OF HUMUS

Humus is the substance that results from the partial decay of plant and animal material in the soil, under certain conditions.

Physical properties

The term humus refers to the physical condition of the material rather than to a definite chemical composition. It is the brown substance that may be dissolved from almost any form of partially decayed organic material, whether plant or animal. It may be seen in the brown liquid that leaches from a manure pile and in the coffee-colored drainage water from swamps. When the water is evaporated, a dark brown to black, horny residue remains. In a small quantity of water it diffuses freely, as does starch, and assumes a gelatinous consistency. Near the point of dryness it shrinks excessively and is inclined to break into small bits. Most of the humous substance is soluble and forms a clear liquid; but closely associated with it is much finely divided material of the same color, which is commonly found in suspension.

Sources of humus

A great variety of materials may serve as the sources of humus. Both the underground and the aboveground parts of terrestrial plants may produce the substance. Under a cropping system that does not return the tops or other organic material to the soil, the chief source of supply is from the roots left in the soil. Stock manures and other forms of waste applied to the land give rise to humus in the soil. Some fertilizers derived from plant or animal material have the same function, as, for example, dried blood and cottonseed meal. Finally, there is in every soil a numerous flora of microscopic plants — some threadlike, others that are single, rounded cells, or bacteria — the death and decay of which give rise to humus. The forms of plant and animal material that may be the source of humus in the soil are of great variety.

Decay

Decay includes all those processes by which organic material is gradually resolved into the simple constituents of water, ash, and gases from which it was originally derived. These changes are due to both chemical and biological processes. A great variety of microörganisms and of chemical changes are involved, and the association of these depends very much on the nature of the soil conditions.

Most of the changes are brought about by fungi and bacteria. A complex succession of forms attacks the material, each one effecting a slight change and the product of one form often becoming the food for the next form of organism. Gradually the material is split up and altered in physical and chemical properties. The difference between fresh and rotten wood illustrates this change.

The purely chemical changes in which organisms are not concerned are illustrated by the process of burning wood. This process consists in the oxidation of carbon to carbon dioxid and of nitrogen into simple forms, such as ammonia, and results in the reduction of the mineral material to ash. It is accompanied by the liberation of much heat, which may be sufficient to raise the temperature of the evolving gases to the point where they glow and form a flame. The net result of both the biological and the chemical changes is to simplify the material and to liberate, in the form of heat, the energy that was stored up during the growth of the plant. The action of the decay organisms on organic material is largely a process of oxidation with the liberation of heat, similar to the process of burning. The process does not go on so rapidly and therefore does not generate so intense a degree of heat as does the chemical change, but the modification of the material acted on is quite as thorough.

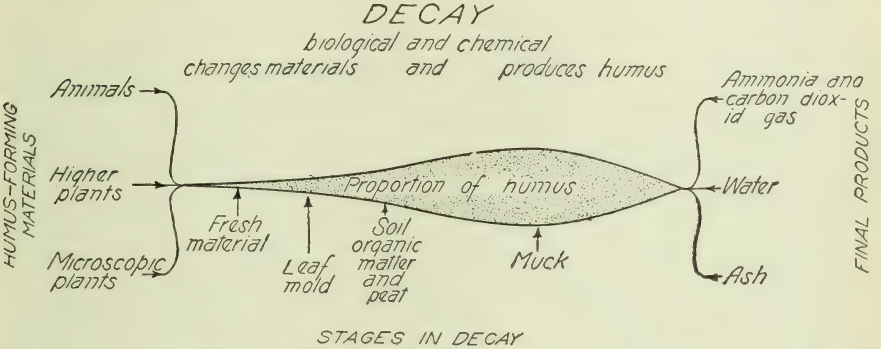

FIG. 2.— *Diagram representing the sources of organic matter, the processes by which it is changed to humus, the proportion of humus in different soil materials, and the final products of the decay of organic matter and humus*

Since there are many kinds of organisms that may cause decay and that thrive under different conditions, and since there may be many kinds of organic material, both plant and animal, in the soil, it follows that the results of these complex processes of decay acting on a great variety of material may produce many substances that make up humus, and the nature of such products will vary with each soil and its physical condition. In other words, many conditions affect the processes of decay of organic material in the soil and the nature of the humus that results.

Conditions that affect the formation of humus

Some of the factors that determine the formation and the nature of humus are the following:

(a) *The ventilation of the soil* has a marked influence on all processes of decay. Many of the organisms that produce humous substance cannot thrive in the absence of air, and chemical changes are reduced in intensity when air is not present.

On the other hand, when the ventilation is too thorough, organic material is quickly destroyed, with very scant production of humus. A moderate amount of ventilation is most favorable for its formation. For example, in well-drained, light sand soil there is usually very little humus, since the organic matter has been either largely destroyed or changed into a form other than humus. In heavy clay, especially in compact clay, the production of humus is hindered. The ventilation represented by good tilth of loam, heavy loam, and clay soils appears to be most favorable for the production of humus, although humus may develop in other soils as the result of special conditions, chief of which is drainage.

(b) *The drainage of the soil* has an intimate relation to ventilation; in fact, the ventilation of the soil is largely determined by the drainage. A poorly drained soil is a poorly ventilated soil. It is for this reason that swamp areas usually have a dark-colored soil, owing to the slow decay of the plant remains and the accumulation of humus. Even light sand under this condition may be rich in humus.

In many sections of the country there are deep deposits of organic material, known as peat and muck, which are relatively rich in humous substance. Muck represents a more advanced stage of decay than does peat, and therefore contains more humus.

In good soil management it is important to regulate the drainage of the soil so as to obtain not only the proper moisture condition of the soil but also a more favorable degree of ventilation.

(c) *The physical condition of the soil* affects the formation of humus through its influence on drainage and ventilation. A good tilth is most favorable for its formation.

(d) *The temperature of the soil* influences particularly the activity of the soil organisms. The organisms are most numerous and active in a warm soil. A temperature of 60° to 90° is most favorable for the formation of humus. At higher temperatures other forms of activity are more abundant and less humus is formed; at low temperature also the formation of humus is retarded.

(e) *The chemical nature of the soil* affects the soil organisms and the nature of the products of decay. The microörganisms are similar to higher plants in their use of plant-food, and the marked deficiency of one or more elements in available form influences the type of growth and the nature of the products. The marked deficiency of phosphorus, for example, interferes with the growth of microörganisms. The basic constituents (lime and associated alkalies) in the soil largely influence the type of growth of the microörganisms and the formation of humus.

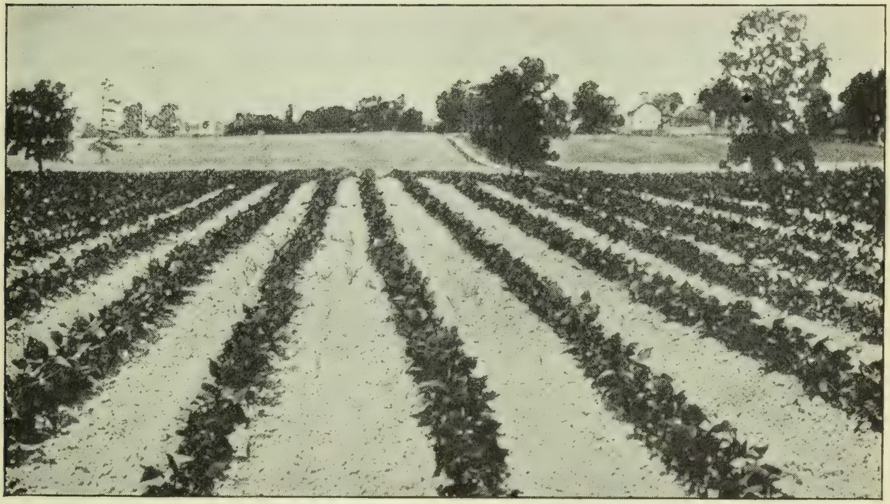

FIG. 3.— *Clay soil deficient in humus. Indicated by the light color and the lumpy condition of the soil, and by the poor growth of the beans*

(f) *Lime carbonate*, in particular, of the basic constituents in the soil, affects the formation of humus. One evidence of the deficiency of lime carbonate is the light color of a soil, which is indicative also of its deficiency in humus. While a fair quantity of organic matter may be present in a decayed form, a very small part of it may be in the humous form, owing to the nature of the decay as determined by the absence of lime and associated influences. When other conditions are essentially the same, those soils that contain the most lime carbonate will have the darkest color, which characteristic shows the presence of the most humus. The soil associated with lime rock and derived immediately from it usually has a dark color. In the States bordering on the Gulf of Mexico there is a belt of soil generally known as the black calcareous prairie (Houston series of soil), the topsoil of which is very dark or black and the subsoil often a chalky, rotten limestone. Lime carbonate insures a sweet condition of the soil and the absence of acids, and, in some way not yet understood, the presence of lime carbonate appears favorable for the formation of humus.

(g) *The kinds of organisms in the soil* influence the formation of humus, as has been suggested above; but these are not under the control of man except as he regulates the nature and the condition of the soil. Whether it may ever be possible to promote the formation of humus by inoculating the soil with particular organisms, as is now done for the production of nodules on legumes, does not appear to have been studied. Briefly, it may be stated that the formation of humus from any organic material is most rapid in a moist, friable soil that is moderately warm and well supplied with lime carbonate.

Chemical nature of humus

Humus is not a definite chemical compound, as was formerly believed. In fact, it is a very complex mixture of organic substances, and the proportion, and probably also the nature of the compounds, differ for each soil. The substances are brought together primarily by the fact that they are measurably soluble and that they form a brown or black gelatinous liquid. Some of the constituents are tar-like. The dark color is probably due in part to the fact that there are particles of free carbon liberated in the amorphous form during the process of decay. Examples of amorphous, or free, carbon are soot and coal dust.

Recent studies of the chemical nature of humus by the United States Bureau of Soils, and by Professor Jodidi and others, have identified a large number of the chemical substances that make up humus in the soil. The fact that humus is made up of such a variety of substances helps to explain some of the beneficial effects of this material on the soil. These substances may unite with the mineral substances in the soil or may affect their solubility, and thereby increase productiveness. Two groups of organic compounds form humus; one group contains nitrogen and the other does not contain nitrogen.

(a) *The nitrogen content of humus* is one of the most important factors in its value. Nearly all of the nitrogen in the soil is combined with the organic matter. That part which is united with the humus is the most readily available. For this reason a dark color of the soil is usually understood to indicate the presence of a large proportion of nitrogen. Most of the nitrogen in humus is present in the form of ammonia compounds. The proportion of nitrogen in these different constituents may range from less than 5 per cent to more than 60 per cent. The type and the proportion of nitrogenous compounds vary in different soils. Analyses of humus from a considerable number of soils show that it contains from 2 per cent to as high as 22 per cent of nitrogen. On an average the humus in soils in arid regions contains more nitrogen than does that in semi-arid soils, and the latter, in turn, contains more nitrogen than does humus in soils in humid regions. An average proportion of nitrogen found in one extensive set of samples of soils from the arid region of California was 15.23 per cent. For a smaller number of semi-arid soils it was found to be 8.38 per cent, and for a still smaller number of humid soils it averaged 4.80 per cent. From 5 to 10 per cent of nitrogen in humus is probably the usual range of composition in the eastern States.

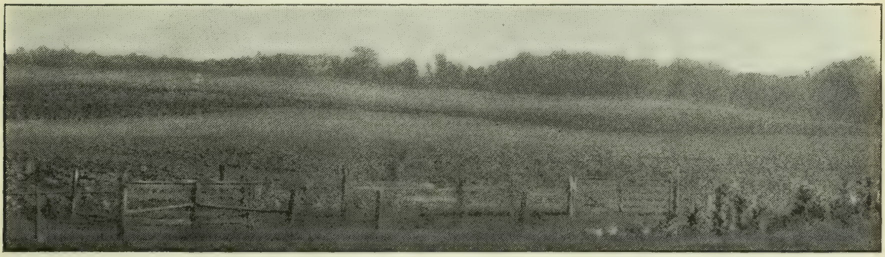

FIG. 4.— *Humus imparts a dark color to the soil. The effect of humus on the color of soil is shown in the above photograph. The higher land, which is low in humus, is light-colored. The low land, showing a black color, is rich in humus*

(b) *Mineral elements*, such as lime, phosphorus, potash, sulfur and iron, are also present in humus. The presence of mineral elements is to be expected from the fact that humus is derived from plant substance.

AMOUNT OF HUMUS IN SOIL

The proportion of humus in different soils varies greatly. It should be understood that only part of the organic matter in soil is in the form of humus. This proportion also will vary. Probably one fifth to one half of the organic matter in soil is in the form of humus.

More data are available for the proportion of organic matter in soil than are available for the proportion of humus. In general, heavy clay soils contain more organic matter than do light sandy soils; soils that are wet contain more than do soils that are naturally well drained; soils in cool regions contain more than do soils under a warm climate; topsoils contain more organic matter than do subsoils; virgin soils contain more than do soils long cultivated, unless care has been used to build up the stock of organic matter.

Sandy soils contain .5 per cent to about 2 per cent of organic matter. Loam and clay loam soils contain 1 to 5 per cent of organic matter. Averages will be nearer the lower than the higher figure.

In swampy areas the soil is often made up very largely of decayed plant remains. These soils are commonly called peat or muck. They differ from each other in the stage of decay. Peat is the earlier stage, in which the fibrous nature of the vegetable substance is still abundant. Muck is the more advanced stage of decay, in which the material has taken on a darker and more pulverous nature and has largely lost its fibrous structure. Muck has the higher crop value. The proportion of organic substance in these soils is commonly 60 to 80 per cent. The proportion of humous substance is much larger in muck than in peat. The total percentage of nitrogen in muck and in peat is approximately 1.6 to 2.5 per cent, and is higher in the former material. This proportion is smaller than in humus from upland soils and illustrates the influence of the nature of the original plant substances and the type of decay on the composition of humus.

Leaf mold is another form of organic matter frequently met in the soil. It is the soft, decayed mass of vegetable substance on the surface of the soil in well-drained situations, especially in timber. It usually has a brown rather than a black color, and illustrates the influence of ventilation on decay. Muck and peat form where the soil is saturated with water. The same type of humous substance may be obtained from leaf mold as from other organic soil materials.

EFFECTS OF HUMUS ON THE SOIL

The importance of humus is due to its numerous benefits in the maintenance of the fertility of the soil. In large measure humus is the active and available form of organic matter. In the undecayed state, all those forms of organic materials that give rise to humus have very little influence on the fertility of the soil. For example, straw is of little value until it has rotted so that it will mix intimately with the mineral matter of the soil.

Other forms of organic material that have a light color and result from decay are present in the soil, and these also have an influence on productiveness. The understanding of their importance is rapidly increasing. Some of these compounds are beneficial and some of them may be injurious. The injurious compounds are sometimes called toxic, or poisonous, substances. Their presence may be the cause of unproductiveness when all other conditions are reasonably favorable.

If the term "humus" is considered in the broadest possible sense to include all decayed organic matter in the soil, its effects may be grouped under three heads: physical effects, chemical effects, and biological effects.

Physical effects of humus

First, the gelatinous nature of humus has a marked influence on the tilth of the soil. It promotes the development of a crumbly, granular condition and lessens the tendency to puddle and bake. A soil rich in humus responds more readily to tillage than does a soil deficient in humus.

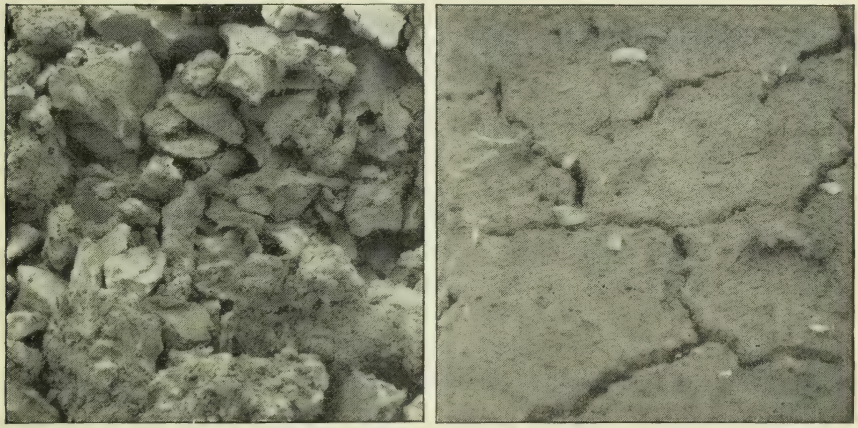

Fig. 5.— *Clay soil deficient in humus. On the left is shown the cloddy structure when tilled; on the right, the puddled and compact structure resulting from exposure during the winter*

Secondly, soil ventilation is improved by humus. This is partially due to the open, granular tilth produced. The larger pore space permits better circulation of air. Good circulation favors deeper rooting and the deeper activity of the microörganisms in the soil.

Thirdly, the capacity of the soil to hold water is increased by humus. This increased capacity is due to the improved granulation of the soil and also to the large amount of water that humus will absorb. Calculated on the basis of dry material, this may exceed 500 per cent as compared with 15 to 40 per cent of water retained by the mineral soil particles of different sizes.

Fourthly, the average temperature of the soil is increased owing to the dark color imparted by the humus, for the dark color increases the absorption of the rays of the sun. When there are dark streaks of soil through the field, provided they are well drained, the seed germinates and begins growth much quicker than on the light-colored soil. On a bright day the difference in temperature may readily be detected merely by the sense of touch.

Chemical effects of humus

First, humus contains readily available plant-food. It is soluble and contains the plant-food elements that were present in the material from which it was derived. These include particularly nitrogen and phosphorus, but all other plant-food elements are present. The availability of these constituents varies with the sample of humus. That obtained from stock manure, green manures, and leaf mold is usually very available. That derived from peat and muck soil, particularly the former, may be quite unavailable when first taken from its natural position. This unavailability is due to a sterilized condition of the soil resulting from the antiseptic properties of bog water.

Secondly, humus increases the availability of the plant-food in the soil particles. As has already been shown, the composition of humus is complex. As a result there is certain to be a union between its constituents and some of the mineral compounds in the soil by which the solubility of the latter is increased. The presence of humus, therefore, insures a larger use of the food in the soil than is possible in its absence.

Biological effects of humus

Humus promotes the growth of many forms of microörganisms by supplying them with food. Some of these organisms perform functions in the soil aside from acting as scavengers. They may gather nitrogen from the air and leave it in an available form for the use of higher plants. They may produce substances that are better able to unite with the mineral particles of the soil than is the original plant substance, and thereby increase the availability of the mineral particles. In an active soil the

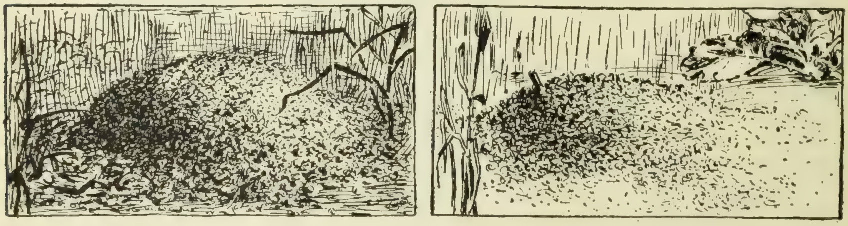

FIG. 6.— *On the right is represented a good sample of muck soil, which has a loose granular structure. On the left is a clay loam soil, rich in humus, to which its excellent granular structure is due. Compare Fig. 5*

number of microörganisms is roughly proportional to the amount of organic matter present. This statement suggests that the processes of change of organic material into humus, and of humus into its simple elements, have in themselves some influence on the nature of the soil. True, the result of these processes may sometimes be injurious when the nature of the soil conditions has given them a wrong direction, but those conditions that produce normal humus — moderate moisture, moderate ventilation, moderate temperature, food, and sufficient lime carbonate — generally insure a beneficial nature in the associated processes.

From the above list of effects of humus, some idea may be gained of how fundamentally important it is to maintain a good supply of humus in the normal soil, and such a practice may be put down as one of the cardinal factors in good soil management. It is one of those problems to which the intelligent farmer is committed and which he must solve by the most practicable means available under his particular system of cropping. Attention may be called to the more common means for building up organic matter and humus in the soil.

MAINTENANCE OF ORGANIC MATTER IN THE SOIL

Any practice that favors the growth and preservation of organic material in the soil or its addition from other sources, aids in the maintenance of humus. There are a number of practices that have this result.

Crop residues

A part of every crop is left on the soil. The roots, particularly the fine feeding roots, decay as soon as the crop is matured. The development of the root system of a crop is proportional to the growth of the top; a large crop, therefore, leaves a large residue. It may appear that this large growth is at the expense of organic matter already present in decayed form in the soil, but the inference is only partially true. Organic substance is made up of less than 5 per cent to perhaps 10 per cent of mineral constituents and nitrogen. The remainder of the material has been built up, or organized, under the influence of sunshine, from the constituents of water and air. The carbon dioxid of the air and the elements of water are the source of the remaining 90 or 95 per cent of the plant substance. The accumulation of organic matter in the soil is well illustrated on every uncultivated area where the growth of plants falls back on the soil and forms leaf mold; the growth of a crop and its return to the soil, therefore, will increase the store of organic matter in the soil. Since processes that destroy organic matter are also in operation, the question is, How much of the crop must be returned in order to balance the loss or to increase the stock of organic matter in the soil? Under favorable conditions the root residues may maintain, or even increase, the stock of humus. If, in addition, a considerable quantity of the aboveground part of the plant can be returned, the process of upbuilding is more rapid.

Plowing under heavy sods and dense masses of roots and stubble is, therefore, the first step in the maintenance of humus. From what has been said, it is apparent that decay on the surface is wasteful of organic matter since the conditions on the surface favor the rapid and complete destruction of plant material. As quickly as possible these residues should be turned under, where their decay will give more permanent results. Those systems of farming which leave the bulk of the crop residue on or near the surface of the soil — especially in the case of sandy or gravelly soil — or which by vigorous cultivation produce rapid decay, are to be avoided if they are not offset by some other method of maintaining the humus. The continuance of grassland without treatment until the sod is largely destroyed is an example of the former objectionable practice. Continuous cropping to vigorously tilled crops, such as corn, potatoes, and truck crops, without manure, represents the latter objectionable phase. It is legitimate to seek large crops, but the producer should strive to conserve the increased residues that they afford. The older practice of burning stubble, straw, and all other rubbish that interfered with tillage,

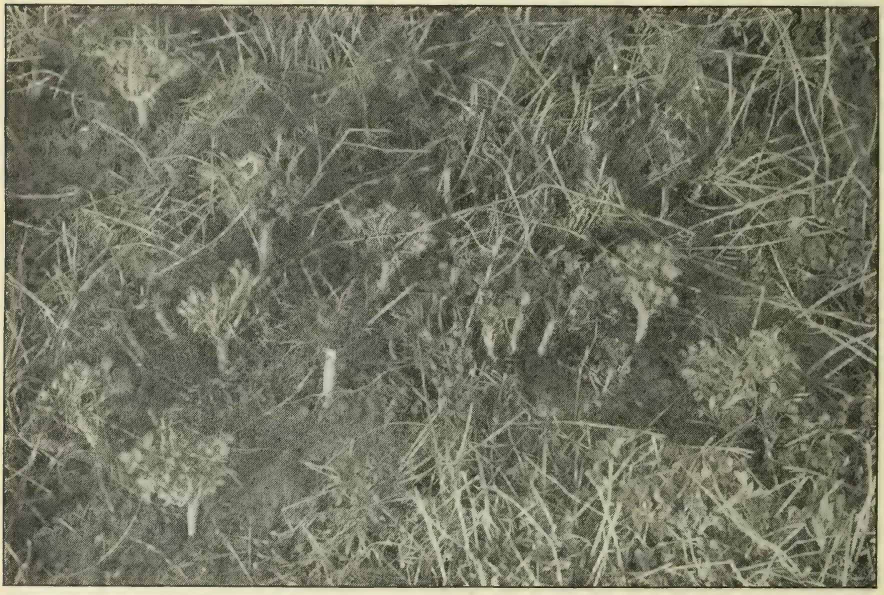

FIG. 7.— *Clover stubble, showing crowns and roots of plants that may produce humus when plowed under*

is therefore to be strongly condemned and has been rather generally abandoned. There may be other conditions, of course, such as the existence of injurious insects or fungous diseases, which would warrant the burning of the crop residue; but it should be clearly understood that this practice is at the expense of the stock of humus in the soil, which must be made up in other ways if the productiveness of the soil is to be maintained.

Crop rotation

When properly adjusted, crop rotation is well known to aid in the maintenance of the fertility and in the upbuilding of the organic matter of the soil. Merely to change the crop does not necessarily accomplish this purpose, although it may have other beneficial results, such as the prevention of injurious insects and plant diseases and the distribution of labor and income.

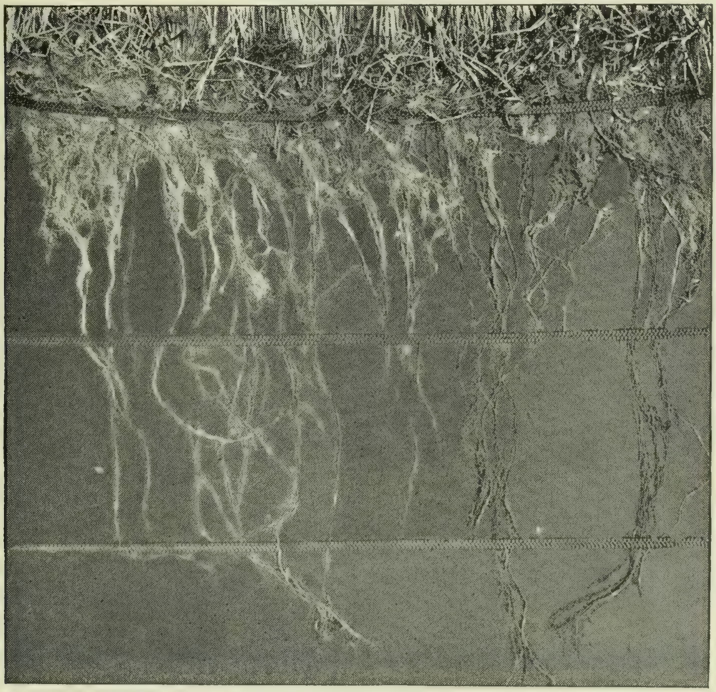

FIG. 8.— *Clover and timothy sod, showing the roots, from which the soil was removed by washing. The deep main roots are those of the clover plants. The timothy roots are fine and fibrous, and develop nearer the surface than do the clover roots. The decay of these roots results in the formation of humus; and the deeper it is distributed, the better the results are likely to be*

Crops differ in the amount of residue that they leave in the soil and in their contribution to the humus in the soil. The best rotations are those that include the growth of leguminous crops in succession with nonleguminous crops. The primary value of this practice lies in the fact that the supply of available nitrogen in the soil is more likely to be deficient than is that of any other element of plant-food. It is not contained in the rock particles of the soil. The chief store of nitrogen is the atmosphere, which, although it is three fourths nitrogen, is retained in a form that higher plants cannot use directly. The leguminous plants — those that have a bean-like seed, such as the beans, peas, clovers, and among trees the locust — have effected a cooperative relation with certain bacteria that grow in their roots, usually producing knotty, or nodular, growths. These bacteria, in return for certain advantages in food supply, are able to use the free nitrogen of the atmosphere in place of the combined nitrogen that may be obtained from the humus in the soil. It is made a part of the substance of the bacteria and brought into a form that may be used by the leguminous plants, either by direct absorption from living bacteria or by the absorption of their decay products after they have died. The net result is that, when the proper bacteria are present and other conditions, such as the supply of mineral elements and lime, are favorable, the leguminous plants are able to grow independently of the available nitrogen in the soil. In this manner they make a large root-and-top development, which, if conserved in the soil, will rapidly build up the stock of organic matter and combined nitrogen. This fact, and the further fact that many of the legumes have a deeper and more extensive system of roots than have the grasses or many other cultivated crops, give them a double value in the maintenance of fertility.

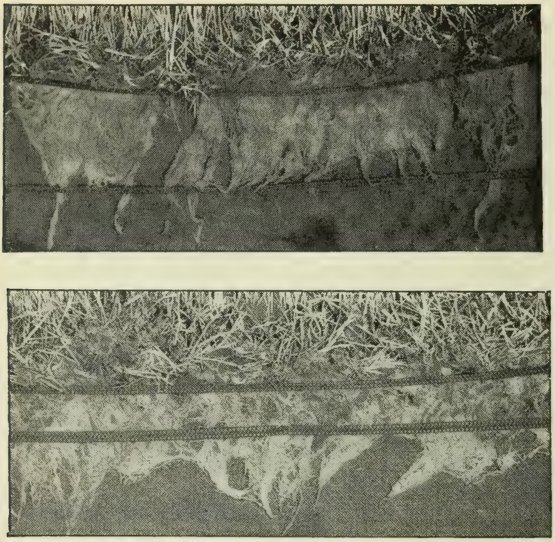

Fig. 9.— *Root growth of timothy. The upper view shows the extent of roots when fertilizer was applied as a top-dressing in the spring. The lower view shows the growth of roots when unfertilized. The fertilizer increases the quantity of organic matter from which humus may be formed*

A common rotation in New York State is corn, followed by oats seeded to clover and timothy, which are allowed to stand for two to five years. During the first year in hay, clover is dominant, after which time it disappears more or less rapidly according to the nature of the soil, and timothy is the dominant grass. If the soil is well adapted to grass — as is true, for example, on the clay land in Niagara county — the timothy may continue to yield a good cut for the full period; but more often it becomes thin after two or three years, and at the end of four or five years the sod is little more than a light mat of weeds. Such a sod has small value as a source of humus. The system is improved by limiting the grass to one or two years, while there is still a good clover turf.

The following are rotations used in different parts of the State and for different conditions:

TABLE 1. CROP ROTATIONS USED IN NEW YORK STATE[1]

First year	Second year	Third year	Fourth year	Fifth year	Sixth year
1. Corn (cover crop)	Oats	Clover	Timothy	Timothy	Timothy
*2. Corn (cover crop)	Oats	Clover	—	—	—
3. Oats (cover crop)	Oats	Clover	Timothy	—	—
4. Buckwheat	Oats	Clover	Timothy	—	—
5. Corn (cover crop)	Oats	Wheat	Clover	Timothy	—
6. Oats	Wheat	Clover	—	—	—
*7. Potatoes	Wheat	Clover	—	—	—
*8. Beans	Wheat	Clover	—	—	—
9. Cabbage (cover crop)	Oats	Clover	Timothy	—	—
*10. Corn (cover crop)	Peas	Wheat	Clover	—	—
11. Buckwheat (cover crop)	Oats	Rye	Clover	Timothy	—
*12. Corn (cover crop)	Oats and peas for hay	Alfalfa	Alfalfa	Alfalfa	Alfalfa

[1] Cover crops may be introduced in the rotation as indicated by parentheses.

The rotations that are best suited to keep up the humus and improve the soil are marked with a star. Each of the rotations includes a legume and either eliminates the period for grass or gives only a short one. Often, lime must be used in order to get a good growth of clover. These rotations are best suited to the lighter grades of soil where grass does not make a first-class growth. On heavy clay soil, the rotation may very well be extended to include two or three years in grass, since it requires several seasons for the common hay grass to make the best sod. By this system the expense of frequent plowing is reduced, and if the sod is turned under while strong it is very helpful in keeping up the humus. It is often a good practice to use manures and commercial fertilizers, especially the latter, as a top-dressing on the timothy meadow in order to keep up its vigor. Such fertilizer, which should be particularly strong in nitrogen, is applied broadcast in early spring at the rate of 150 to 300 pounds per acre. Rotations 10 and 12 are especially effective for improving the soil where they may be applied. In young orchards, rotation 8 has proved very satisfactory.

The amount of material left in the soil by some crops is as follows:

TABLE 2. Residue of Hay Crops, Roots, and Stubble

State	Crop	Dry matter in surface foot of soil (pounds per acre)
Nebraska	Red clover	
	Sown in April, harvested on October 21	1,882
	Alfalfa	
	Sown in fall, harvested in November of following year	3,650
	Alfalfa	
	Five years old	5,478
	Alfalfa	
	Eight years old	5,069
	Same field. Roots in the second to tenth foot inclusive	4,171
Illinois	Sweet clover	
	Roots to depth of 20 inches	3,748
New York*	Clover and timothy. Old sod fertilized	
	Roots to depth of 8 inches	11,000
	Clover and timothy. Old sod unfertilized	
	Roots to depth of 8 inches	7,700

*See Fig. 9.

Green manures and cover crops

The regular crop residue may frequently be supplemented by plowing under the second growth of a crop such as clover, and by planting a crop between the regular crops of the rotation. In the list of rotations given above, the place for the introduction of a green-manure crop is shown in parentheses — for example, rotations 1, 3, 5, and 10.

A green-manure crop is one that is grown exclusively to be plowed under for manurial purposes. When it protects the ground from washing during the winter, it is also a cover crop; and when, in late summer and in fall, it occupies soil that otherwise would be bare, it is a catch crop since it holds the plant-food made available during this period. Usually, the

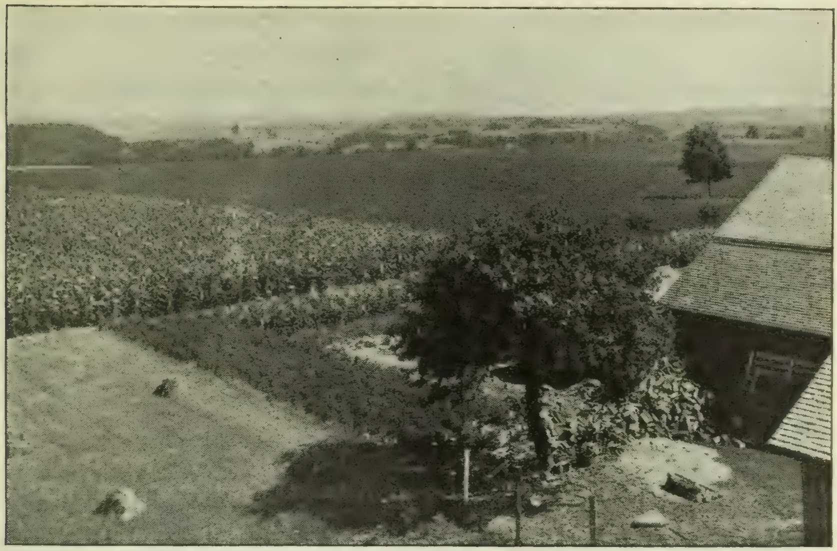

FIG. 10.— *The rotation of crops aids in maintaining the stock of humus in the soil by increasing the quantity of organic matter to be worked into the soil. This view shows corn, potatoes, and grain, the latter being followed by two or three years in grass including a legume*

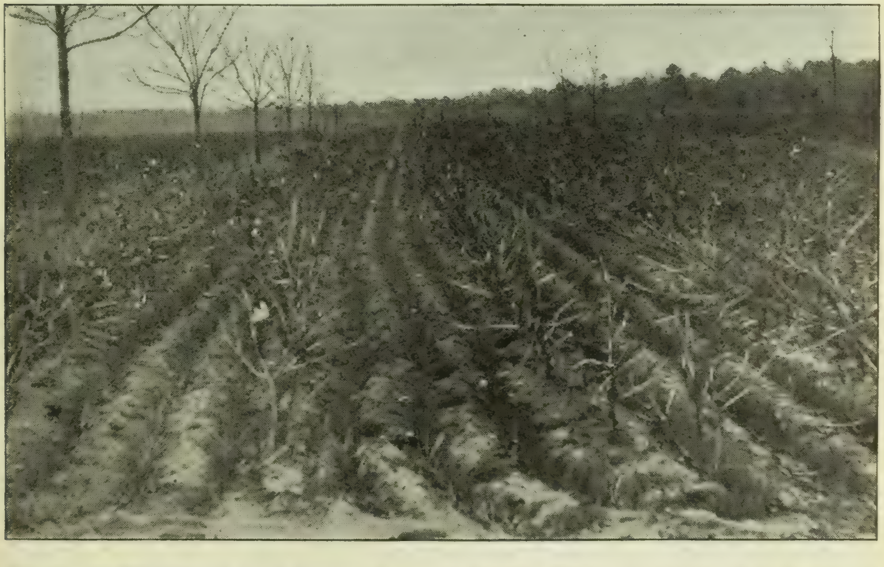

FIG. 11.— *Winter oats sown between the rows of cotton for a cover crop and to be plowed under in the spring as a green-manure crop. This practice is sometimes employed in the Southern States. In the Northern States, rye, rape, and cowhorn turnip may be used in the same way*

green-manure crop is introduced in the late summer and fall and is plowed under in the following April or May. Either a legume or a nonlegume may be planted. Often a crop of buckwheat or rye or rape is used in the place of clover because of the lower cost of the seed. The nonlegume is much better than no cover crop, but is not so good as the legume since it does not gather any nitrogen from the atmosphere.

In the use of legumes for green-manurial purposes, and for any purpose in which the maintenance of fertility is involved, it is important that the knots, or tubercles, be present on the roots. They indicate that the crop is gathering nitrogen from the atmosphere and is not merely subsisting on the soil like other crops. The use of lime alone will not insure their presence if the legume has not been frequently grown on that soil, and the practice of inoculation, or the artificial introduction into the soil of the proper bacteria, is advisable. These will thrive only in a sweet (neutral, or alkaline) soil. Inoculation may be accomplished in two ways. The older and more common method is the transfer of soil from a field where the crop has been grown and has developed nodules; two or three hundred pounds of soil are applied per acre. The newer method is to use pure cultures of the bacteria on prepared media. Several forms of cultures are on the market but they are still somewhat in the experimental stage. Inoculation alone does not necessarily insure the development of nodules, but on soil where conditions are favorable — that is, well drained,

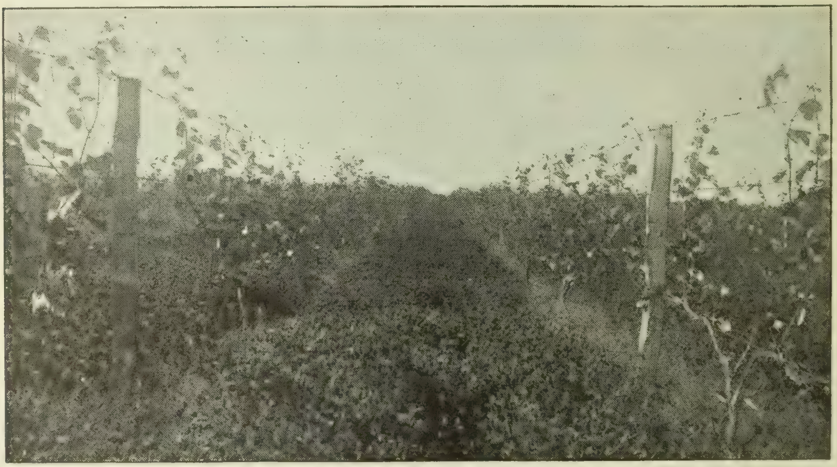

FIG. 12.— *Crimson clover sown in a vineyard as a green-manure crop, to be plowed under in April or May. A legume is generally preferred to a nonlegume; it can grow independently of the available nitrogen in the soil, and thereby may add to the supply of that element in the soil for succeeding crops*

sweet, and reasonably well supplied with available plant-food — it is a material aid.

It is not important that the green-manure crop shall reach maturity. In fact, better results are obtained if it does not grow too large before it is plowed under, for it decays more readily in the green condition. If allowed to approach maturity the green-manure crop not only reduces the soil moisture for the succeeding crop, but becomes so woody that it does not decay readily. As a rule, the larger the growth is, the deeper it should be plowed under. On very heavy clay or on wet land this practice should be modified. The amount of materials furnished by some common green-manure crops was as follows:

TABLE 3. YIELD OF DRY MATTER IN GREEN-MANURE CROPS

State	Crop	Dry matter per acre	
		Yield in pounds of top	Weight of roots in surface foot of soil (pounds)
Nebraska	Red clover Sown in April, harvested on October 21	3,976	1,882
Delaware	(All crops sown on July 22 and harvested November 7 to 22)		
	Red clover	2,819	1,202
	Crimson clover	5,372	413
	Vetch	3,064	600
	Soy beans	6,790	756
	Cowpeas	3,718	310
	Rape	5,533	900
	Cowhorn turnip	2,565	2,902

Stock manure

The most common method of keeping up the supply of humus in the soil, and otherwise adding to its productiveness, is to apply stock manure. One third to one half of the feed consumed by animals is regained in manure, and this with their bedding makes the best form of material for use on the soil. That part which has passed through the animal has been partly broken down and decomposition has begun; in a favorable soil it quickly changes to humus. The bedding is also affected by its contact with the manure, but its value varies with its source; straw is better than shavings, although the latter have a certain value. A ton of manure carries 400 to 1000 pounds of organic matter, in which there are 8 to 12 pounds of nitrogen, 4 to 8 pounds of phosphorus, and 8 to 15 pounds of potash. It has long been the chief means of keeping up the stock of organic matter in the soil. Its conservation and its wise use constitute the first rules of good soil management. To obtain manure has often been the chief motive of many farmers in keeping stock, and the practice is not to be discouraged. Under many conditions, however, the keeping of stock is impracticable, and under other conditions the manure produced is inadequate. It should be remembered that in order to use any form of organic material effectively the soil must be in good condition — well drained, sweet, and well tilled; otherwise the manure may prove ineffective. For farms near cities, or in very intensive farming, such as truck gardening, manure may be shipped from city stables. The cost of this material is sometimes high and for the great majority of farms this material is unavailable. Possibly 10 per cent of the tilled land might be supplied with manure from the city. In those regions that are devoted to stock-raising, 40 per cent more of the tilled land might produce enough manure to receive a moderate application once in five years. For the remaining 50 per cent of the tilled land no manure is available. If all the manure from all the stock in the State were saved, it would be sufficient for an application of only ten tons of organic matter per acre once in ten years.

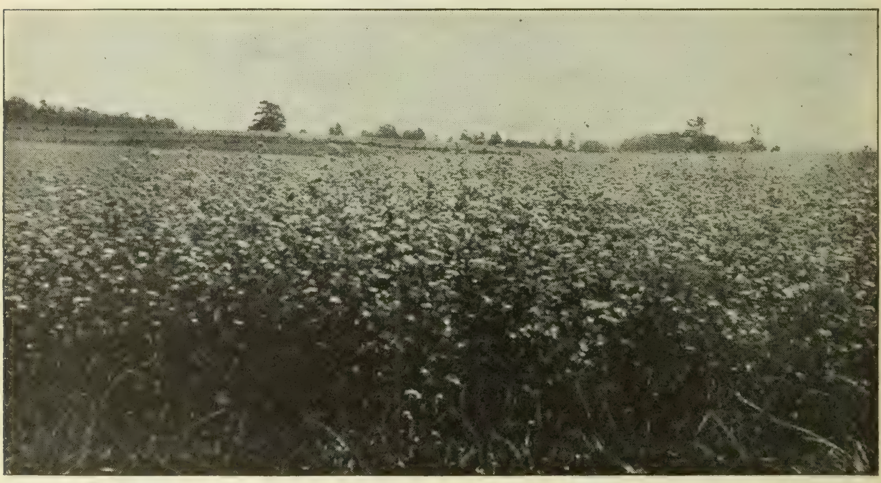

FIG. 13.— *Buckwheat is an excellent green-manure crop on run-down, heavy soil. The low cost of seed is a point in its favor. The use of a little commercial fertilizer on nonleguminous, green-manure crops is often good practice*

When it is further considered that one third to one half of the manure may be lost by careless handling, it is apparent how inadequate is the supply of stock manure to keep up the organic matter in the soil. At the same time these facts emphasize the importance of the conservation of manure and its application to the soil. A horse or a cow weighing 1000 pounds will produce 8 to 10 tons of manure per year, containing 2 to 4 tons of organic matter that was obtained from 5 to 12 tons of feed. At least as many acres of land as there are tons of feed are required in order to produce this feed. These statistics also illustrate how inadequate is stock manure alone to keep up the humus of the soil under intensive farming.

Moderate applications of 6 to 15 tons of manure per acre every three or four years give better net results than do larger applications at longer intervals. The use of manure to top-dress grain and newly established meadows is good practice, and much of what is lost by decay on the surface is gained in the mulch protection and in the larger stubble. When manure is not applied to a growing crop it should be turned under or worked into the soil as soon as practicable, the better to direct the process of decay and to favor the production of humus. The same principle applies to the management of a green-manure crop; but sometimes other considerations, such as the protection of the soil during winter, may demand that the turning-under be deferred until spring.

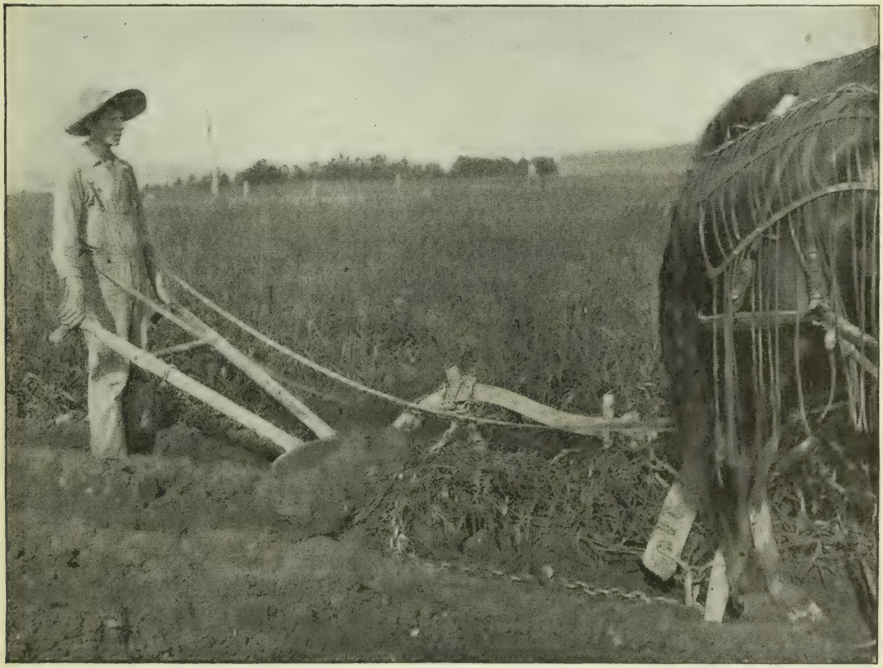

FIG. 14.— *Green-manure crops should be plowed under as soon as they have attained the desired growth. A heavy chain attached to the plow beam and to the whiffletree materially aids in this process*

Other sources of organic matter for the soil

In addition to crop residues, green manures, and stock manures, there are some other forms of organic manure available. In New York State, in particular, there are many beds of peat and muck soil scattered about in small areas. This material, when dry, contains 60 to 80 per cent of organic matter (as has been stated above) and carries about 2 per cent of nitrogen. It may therefore be used as a manure on the soil. The more it has decayed — that is, the better the muck — the more efficient it will be in the soil. Reports are frequently heard of the successful use of this material on the land. There are also reports of injury from its use, the cause of which appears to be some particular character of the muck or of the soil to which it is applied, or perhaps both. The subject has not been sufficiently investigated to permit any statement of the conditions

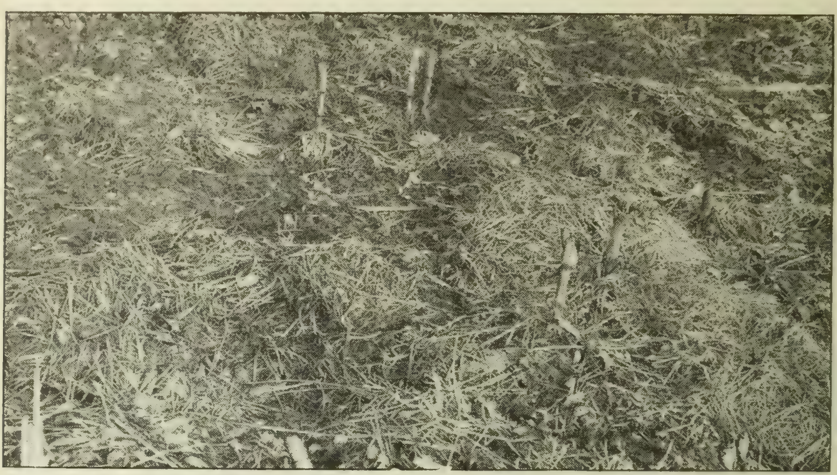

FIG. 15.— *Stock manure spread on corn stubble by hand. The distribution is uneven*

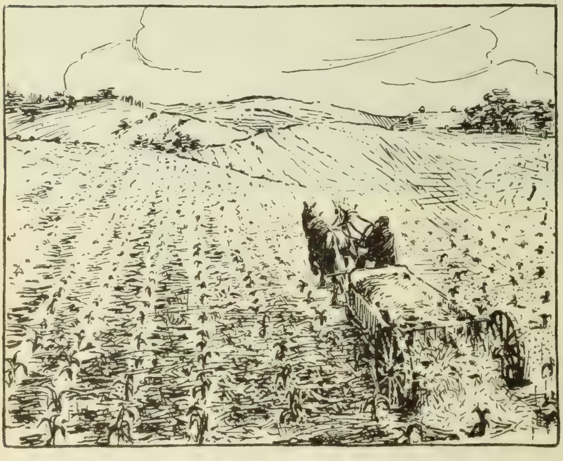

FIG. 16.— *Manure is often used to advantage as a top-dressing on growing crops. This view illustrates its application on corn*

under which successful results will invariably be obtained. In any particular case, therefore, muck would best be used experimentally at first until its value has been demonstrated. Muck is relatively a much more stable form of organic matter than are green plants or stock manure. It is partially sterilized, and this condition must be overcome by mixture with active soil. In general, muck soil that has been cultivated and that gives good crops may be considered a much better form of organic matter for upland soil than is raw or unproductive peat. Sometimes muck soil is impregnated with marl, a form of soft limestone, and this makes an excellent combination. When marl is absent, it is a good plan to use lime in connection with peat on the soil.

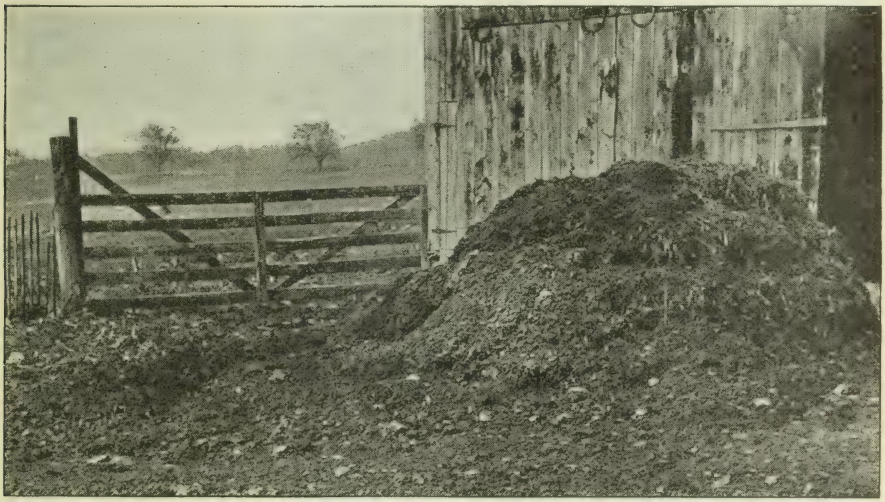

FIG. 17.—*Humus-making material going to waste. Manure should be distributed in the field as soon as possible after it is made*

Muck in the bed contains 80 per cent to more than 100 per cent of water, so that long hauls of the fresh material are to be avoided. Often it is advisable to expose the material on the higher, drier land in a flat pile, where it may weather and dry out preparatory to further hauling. An excellent supplement to stock manure is dry muck or peat as an absorbent in the yard. This increases the value of both the manure and the muck. Lime should not be mixed with the manure. As a fertilizer, both muck and manure are deficient in the mineral constituents, phosphoric acid and potash, and the use in the stable and on the manure heap of small amounts of these elements in combinations that have an acid constituent is good practice. Applications of 10 to 30 pounds of fertilizer per ton of manure are sufficient.

Many of the materials sold as commercial fertilizer, especially those that contain nitrogen, contain also a large proportion of organic matter. Tankage and dried blood from slaughtering houses are such materials. Cottonseed meal, castor pomace, and cottonseed hulls are forms of vegetable fertilizers that are serviceable for the organic matter that they furnish, as well as for the plant-food constituents that they contain. Their cost, however, generally prohibits dependence on them for the maintenance of the humus in the soil.

FIG. 18.— *Alfalfa produces more hay, and, under conditions favorable to its growth, leaves a larger amount of organic matter in the soil, than any other forage crop produced in New York State. This view shows an excellent growth in the Hudson Valley*

The employment of the methods of maintaining humus that have been discussed must necessarily vary with the conditions on each farm. The more deficient the soil is in that constituent, the greater is the care that is necessary to build up the supply, and it may be necessary to forego a crop for a season, to incur the expense of a green-manure crop between regular crops, or to purchase city manure. These are questions to be decided by each farmer in the light of local conditions.

SUMMARY

1. Humus is the dark-colored, gelatinous material derived from the decay of organic matter in the soil.

2. Humus contributes in many ways — physical, chemical, and biological — to the productiveness of the soil.

3. The production of humus from organic matter is greatly dependent on the chemical and the physical nature of the soil. It is favored by moderate ventilation, moderate moisture, a temperature of 60 to 90 degrees, and a slightly alkaline nature of the soil.

4. Humus, as the term is commonly used, does not include all the products of organic decay in the soil, and is not a definite chemical compound but is a mixture of a large number of substances that result from the decay of organic material. One fifth to one third of the organic matter in the soil is in the form of humus.

5. Humus is the chief material in the soil that contains nitrogen. The percentage of nitrogen ranges from 2 per cent to more than 15 per cent. Deficiency in humus, therefore, is an indication of a deficiency of available nitrogen in the soil.

6. The loss of humus is usually the most potent fact in the so-called exhaustion of soils.

7. The supply of humus is dependent on the stock of organic materials, both vegetable and animal, which find their way into the soil, and in farm practice it may be partially or wholly maintained in several ways.

8. The stock of humus in the soil is maintained by means of crop residues — roots and stubble — supplemented by crop rotation including legumes and by inoculation with nodule-forming bacteria when necessary; by the application of stock manures and all forms of organic waste; and by the growth of crops to be plowed under for manurial purposes, commonly called green-manure crops.

9. All forms of organic material undergo the change to humus better when plowed under than when left on the surface of the soil. Wise tillage, therefore, is a serviceable adjunct to the maintenance of humus in the soil.

10. The extent of the effort to maintain an adequate supply of humus should depend on the nature of the soil, on the crops produced, and on the extent to which organic material is naturally changed into humus. These facts and the adjustment of an effective system for the maintenance of the fertility of the soil must be largely determined by the observation and the judgment of the farmer.

ADVANCED READING

The Reading-Course lessons are designed merely to introduce the subject; they are elementary and brief and are intended to arouse a desire for fuller knowledge along particular lines. The study of Reading-Course lessons should be introductory to the study of standard agricultural books and of the bulletins of the United States Department of Agriculture and the state experiment stations. The Supervisor of the Reading-Course will suggest, as far as possible, agricultural literature to meet the needs of any reader. Particular books or bulletins are recommended because they are thought to be of special interest to the reader in his individual study and not because they are considered superior to others on the same subject.

Books

Van Slyke, L. L. Fertilizers and crops. (Chapter viii, pages 117-144.) Orange Judd Company, New York. $2.50.

Lyon, T. L., and Fippin, E. O. Principles of soil management. (Pages 119-133.) The Macmillan Company, New York. $1.75.

Hilgard, E. W. Soils. (Chapters viii and ix, pages 120-160.) The Macmillan Company, New York. $4.

Federal bulletins

Snyder, A. H. Humus in its relation to soil fertility. U. S. Agr. Dept. Yearbook **1895**:131-142. Distributed by congressmen.

Schreiner, Oswald, and Shorey, E. C. The chemical nature of soil organic matter. U. S. Agr. Dept., Bureau of Soils. Bulletin 74. Distributed by the Superintendent of Documents, Washington, D. C. Price, ten cents.

State experiment station bulletins

Walker, G. W. The relation of different systems of crop rotation to humus and associated plant-food. Minnesota Agr. Exp. Sta. Bulletin 128:165-186. 1912.

Morse, F. W. Humus in New Hampshire soils. New Hampshire Agr. Exp. Sta. Bulletin 138:191-203. 1908.

Pinny, Charles L. Cover crops as green manure. Delaware Agr. Exp. Sta. Bulletin 60:1-44. 1903.

Close, C. P. Orchard cover-crops in Delaware. Delaware Agr. Exp. Sta. Bulletin 61:1-32. 1904.

THE CORNELL READING-COURSE FOR THE FARM

The Cornell Reading-Course for the Farm aims to assist those who desire to read reliable agricultural literature. It provides an opportunity for those who are unable to leave their work to receive in their homes consecutive instruction on subjects of particular interest. The course is conducted by means of printed lessons dealing with practical agricultural problems. Certain lessons discuss fundamental principles which should be understood by those who wish to farm most successfully; others contain concrete suggestions or give detailed directions for the best practices. Below is given a list of available lessons showing the arrangement by series. The number of lessons available is increased by the publication of a lesson each month, which is added to the appropriate series. The new lessons are sent to readers as issued. Enrollment in the course is by series. Each lesson is accompanied by a discussion paper which contains questions on the important points in the lesson. If the discussion paper is returned it is read carefully, and a personal reply is made when information is requested. Another Reading-Course lesson in the same series is sent on the receipt of a discussion paper whether the questions are answered or not, as the return of a discussion paper indicates the reader's desire for further instruction. It is hoped that the discussion paper not only will assist the reader, but also will bring the College and the individual farmer into a more intimate relationship. The College appreciates any expression of opinion by readers, as the experience of those in touch with local conditions enables them to present a point of view which is of great value.

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The soil	2	The soil: its use and abuse
	42	Tilth and tillage of the soil
	50	Nature, effects, and maintenance of humus in the soil
Poultry	4	Incubation — Part I
	6	Incubation — Part II
	10	Feeding young chickens
Rural engineering	8	Knots, hitches, and splices

SERIES		LESSONS
Farm forestry	12	The improvement of the woodlot
	28	Recent New York State Laws giving relief from taxation on lands used for forestry purposes
	40	County, town, and village forests
The horse	14	Horse-breeding to increase the farm income
	46	Feeding and care of the horse
Dairying	16	Practical dairy problems
	32	Composition of milk and some of its products
Fruit-growing	18	The renewal of the neglected orchard
	22	The culture of the currant and the gooseberry
	36	Culture of red and black raspberries and of purple-cane varieties
	48	Culture of the cherry
	52	Culture of the blackberry (in press)
Farm crops	20	Alfalfa for New York
	24	The rotation of farm crops
Stock-feeding	26	Computing rations for farm animals
Vegetable-gardening	30	Hotbed construction and management
	34	Home-garden planning
Plant-breeding	41	Improving plants by selection or breeding
	38	Principles and methods of plant-breeding
	44	Methods of breeding oats

The above list is correct to October 15, 1913. The demand may at any time exhaust the supply of particular numbers. Requests will be filled as long as the supply lasts.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE
NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
ENTERED AS SECOND-CLASS MATTER AT THE POST OFFICE AT ITHACA, NEW YORK
W. A. STOCKING, JR., *Acting Director* A. R. MANN, *General Editor*
COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL III. No. 50 ITHACA, NEW YORK OCTOBER 15, 1913 THE SOIL SERIES No. 3

NATURE, EFFECTS, AND MAINTENANCE OF HUMUS IN THE SOIL

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if information is requested.

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1. To what extent is the soil in your region stocked with humus, as indicated by its physical properties? State your observations of the color of the soil in your region.

2. Do you consider that the virgin stock of humus, in the soil of your region, has been greatly reduced in the period since tillage began?

3. In your region what means are employed to keep up the supply of organic matter in the soil? Are these the best means available to your region?

4. What, if any, effects of humus on the soil have you observed in your farm practice?

5. What rotations of crops are in use in your region? What are the reasons for the employment of these rotations?

6. Do clover crops thrive on the soil in your region? To what extent, if any, does the use of lime improve the growth of clover?

7. To what extent are green manure crops grown? What crops are employed for that purpose, at what season are they seeded, and when are they plowed under?

8. At what stage of growth do you consider it best to plow under a green manure crop? Why?

9. What quantity of manure is commonly applied per acre in your region? By what method is it usually applied?

10. What observations, if any, have you made as to the relative benefit of manure when used as a top-dressing and when plowed under?

11. Is there any muck or peat soil in your region? Has it ever been used as a manure for upland? What are the results from its use?

12. In your region to what extent do nitrogen fertilizers give beneficial results on soil rich in humus?

Name ....

Address..

Date..,

The Cornell Reading-Courses

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VOL. III. No. 52 NOVEMBER 15, 1913 FRUIT-GROWING SERIES No. 5

CULTURE OF THE BLACKBERRY*

C. S. WILSON

The cultivated blackberry is a comparatively new fruit, which was introduced into America about 1850. The first variety, named Dorchester, was a chance seedling, and most of the later varieties have been found among wild plants or as a chance growth in the garden or the commercial patch.

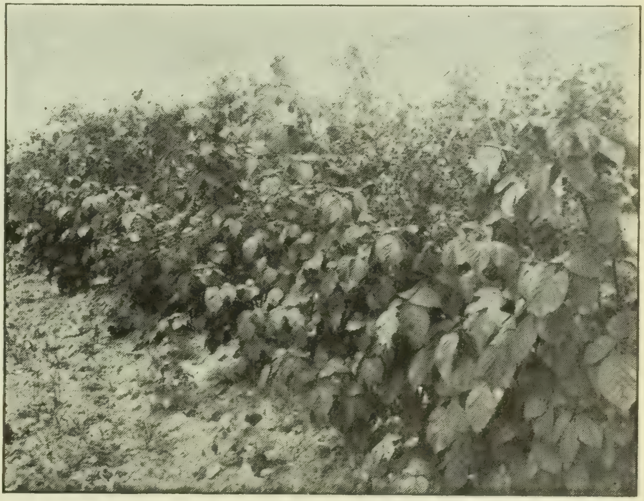

FIG. 19.— *A row of Snyder bushes. One of the hardiest varieties*

In New York State at the present time the blackberry is a neglected fruit. This neglect is not justifiable, since the blackberry is especially well adapted for use in local markets and for home consumption. Usually its yield is higher than that of the other bush fruits. The berries are large and attractive, and, when properly ripened, are as delicious as any fruit that can be grown. It has often been asserted that the blackberry is bitter and sour, but this is the fault of the grower, not of the fruit. If picked too soon the berries are unpleasantly acid, but if they are left until properly ripened they are sweet and luscious. In order to be ripe, it is not sufficient that a berry be black; the fruit should be left on the bush until it separates easily from the stem when the cluster is jarred. When picked before it is ripe the fruit often turns a dull red, thus presenting an unattractive appearance in comparison with the glossy black of well-ripened berries. Much of the present disfavor into which the blackberry has fallen is due to the carelessness of growers who place unripened fruit on the market.

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* The author is indebted for data in preparing this bulletin to Miss Margaret Connor, who, as a student in the Department of Pomology, New York State College of Agriculture, wrote a thesis on the blackberry.

FIG. 20.— *The blackberry in its original home*

Commercially the blackberry is grown only to a moderate extent, although it is a promising fruit and deserves wider planting. It is prolific and is readily propagated. It ripens at a season when few fruits are on the market, for the other bush fruits have gone and the tree fruits, with the exception of early peaches, have not yet matured. Few of the objections to the blackberry are serious. Although the plant is often the least hardy of the bush fruits, one of the many hardy varieties that will not be liable to winter injury may be selected for planting. The difficulty of shipping well-ripened berries to distant markets is a real handicap and one that will largely confine their use to the local market and to home consumption.

No home garden should be without a patch of blackberries, for it is here that their delicious quality can be fully developed without sacrifice of firmness or the loss that attends shipping. The fact that the blackberry furnishes fresh fruit at a season that is often destitute of any other is not to be ignored.

SOILS

In general, a soil that is adapted to the raspberry* will grow blackberries well. With the exception of the extremely heavy and the extremely light types of soil, good results may be expected in almost any locality. Moisture is essential — probably more essential in the case of the blackberry than in the case of the other bush fruits, because the blackberry is the last of these fruits to ripen. Often summer droughts seriously affect the amount and the quality of the fruit, and therefore a soil that catches and holds the rain is highly desirable. A slight preference is shown for the heavier soils, on which the winter injury appears to be less, although the lighter types give excellent results. When the heavier soil is chosen it should be well drained, either artificially or naturally; usually artificial drainage is advisable. The blackberry will prove a failure on wet soil.

Like the raspberry, the blackberry prefers some shade. For commercial plantings a northern exposure should be chosen. In the garden the shadow of a building, a fence, or a tree will promote the growth of the bushes, although the blackberry has given excellent results in places where such a favorable condition is lacking.

PROPAGATION

The blackberry is one of the easiest fruits to propagate. For the purpose of propagation either root cuttings or suckers may be used, although the latter are employed more extensively by commercial growers. The underlying principle of the two methods is the same.

Cuttings.— In the fall the old roots may be dug up and divided into pieces that are called cuttings. Each piece should be one eighth of an inch, or more, in diameter, and two or three inches in length. The pieces should be covered with cool, moist sand and should be stored in the cellar during the winter. This treatment will cause the callus, or the tissue that develops over the end of a cutting, to begin growth. Early in spring, after the ground has been prepared, the calloused cuttings are taken from the cellar and planted in rows, being placed about ten inches apart and planted three inches deep. The plants will be large enough to be transplanted by the end of the season. Root cuttings may be made in the spring and planted immediately, but more vigorous growth will result if the cuttings are given the winter treatment.

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* Described in Cornell Reading-Course Lesson No. 36, "Culture of Red and Black Raspberries and of Purple-cane Varieties," page 106.

Suckers.— Suckers are new shoots that spring from the root of the parent plant. It is the nature of the blackberry bush to put forth many young shoots, the growth of which may be hastened and the number increased by proper treatment. It has been found that wherever a root is broken or bruised a new plant will grow at the wound. A spade thrust into the ground in different places about the bushes will produce these wounds; new plants will spring up at each cut, and when these are large enough they may be dug up and transplanted. The growth of the suckers will be encouraged if stable manure is applied when the roots are bruised. In western New York, when new patches of blackberries are set out it is the common practice to propagate the bushes by digging up young shoots from mature bushes rather than to buy plants from nurserymen. This practice is to be expected, because the suckers spring up in large numbers and the farmers have an abundance of strong young plants when they are needed. If a plantation is infested with insect pests or diseases, however, it is a more economical procedure to cut down and burn all diseased plants and buy nursery stock for the new field.

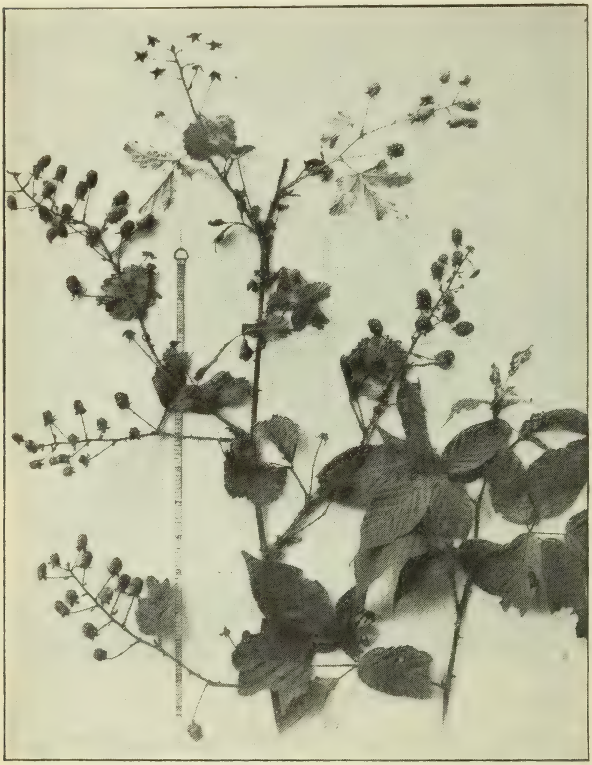

FIG. 21.— *The fruit of the wild blackberry is small but sweet*

VARIETIES

Great care should be exercised in the selection of varieties, for on the choice may depend the success or the failure of the blackberry in any district. In the cooler parts of the United States, growers should choose hardy varieties in order to diminish the dangers of winterkilling. On the plains, resistance to drought is essential. In the States of the Pacific Coast, where all bushes reach a much larger size than do those of the eastern States, there are many large and vigorous varieties that are not suitable for growing in the East. Every grower should endeavor to choose the varieties that ship well, have an attractive appearance, give large yields, and are least susceptible to diseases and insects. The three principal varieties in western New York are the Snyder, the Blowers, and the Eldorado. The Ward, the Rathbun, and the Chautauqua are grown in small quantities. The Chautauqua, which originated from a chance seedling, has given remarkable yields on one small patch where it has been cultivated. A prolonged ripening season is a marked characteristic of this variety.

The following commercial classification of varieties is taken from a publication* of the Geneva Agricultural Experiment Station, where a study of this fruit has been made:

Hardiness.— The following is a list of the hardy and tender sorts. Observations were made for several years; the list of hardy sorts includes those not injured over twenty-five per cent; the list of tender ones, those injured severely, in some cases as high as ninety per cent.

Hardy or nearly so

- Agawam
- Ancient Briton
- Chautauqua
- Eldorado
- Fruitland
- New Rochelle
- Ohmer
- Snyder
- Stone Hardy
- Taylor
- Tyler
- Wachusett

Not hardy

- Allen
- Black Chief
- Bow Cane
- Childs Tree
- Clark
- Clifton
- Dorchester
- Early Harvest
- Early King
- Early Mammoth
- Florence
- Ida
- Kittatinny
- Lovett
- Mersereau
- Minnewaski
- Rathbun
- Reyner
- Success
- Wilson Jr.

Earliness.— The time of fruiting varies so much that no very satisfactory list as to season can be given. Some varieties have a long season, others ripen early or late, depending on character of soil and exposure. The following is a list of those varieties from which fruit was picked early in the season and those giving good yields near the close of the season.

Early

- Agawam[1]
- Allen
- Early Harvest

[1] Long season

Late

- Agawam[1]
- Ancient Briton
- Chautauqua

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*O. M. Taylor. Varieties ef raspberries and blackberries with cultural directions, pp. 133-134. New York (Geneva) Agricultural Experiment Station. Bulletin 278.

Early	Late
Early King	Childs Tree
Eldorado	Florence
Minnewaski	Mersereau
Rathbun	Ohmer
Wilson Jr.	Success
	Taylor
	Tyler

Description of varieties

Agawam.— Fruit medium to large, oblong; color glossy black; flesh firm, juicy, sweet; quality good; season mid-early. This variety is popular, being hardy, productive, and able to withstand drought. It has proved one of the best for southern Canada.

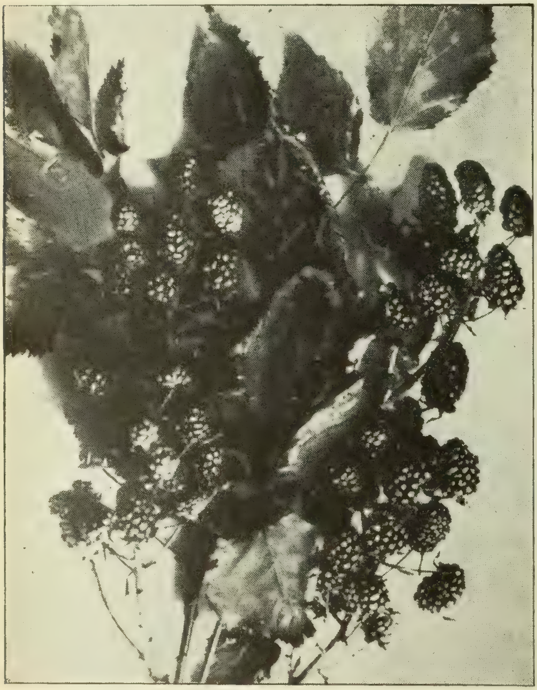

FIG. 22.— *Ancient Briton*

Blowers. —A vigorous grower and a good cropper; fruit large, sour until ripe and readily salable; color glossy black; quality good; season early. This variety originated on the farm of Mr. Blowers, Chautauqua county, New York, where it is now grown with excellent results. The chief objections seem to be liability to winterkilling and an uneven ripening over a long season.

Eldorado. — Fruit medium to large, round to oblong, conical; color jet-black, attractive; flesh firm, juicy, sweet, a good shipper; flavor very good; quality excellent; season mid-early. This variety is a great favorite in our western and middle western States, being a strong, hardy grower and a long cropper. Although inclined to scanty bearing in certain sections, in western New York it is productive.

Kittatinny.— Fruit large to very large, round to oblong; color rich glossy black; flesh moderately firm, juicy, sweet; flavor good; quality good to very good; season early. Another old and popular variety and a long cropper. It is moderately productive, but is subject to winter-killing and to attacks of red rust.

New Rochelle (*Lawton*).— Fruit very large, oval; color intensely black when fully ripe; flesh, if gathered when ripe, soft, juicy, sweet; flavor good; quality very good; if picked too early, it is sour and insipid; a vigorous and heavy cropper. This was the second variety of blackberry to be cultivated, and it did much to popularize the fruit. It is the principal variety in Oregon.

Mersereau.— Strong, upright grower, productive; fruit extra large, round to oblong; color brilliant black; flesh sweet, rich, melting, without core; flavor good; quality good. A promising fruit for home use and for the market.

Snyder.—Vigorous and productive, growing tall, upright, healthy canes; fruit medium, nearly round; color brownish black to pure black, tendency to turn red if exposed to sunlight too long; flesh firm, juicy, sweet; flavor mild and pleasant; quality medium to good; a good shipper. This is one of the oldest, the best known, and the most reliable varieties. It is less attractive than the Eldorado and commands lower prices.

Taylor. — Hardy and productive; canes round and of a peculiar yellow-green color; young plants slender and trailing; fruit large, roundish oblong; flesh soft, rich, juicy; flavor very good; quality excellent. This is one of the best late varieties of blackberries, ripening about two weeks after the Snyder.

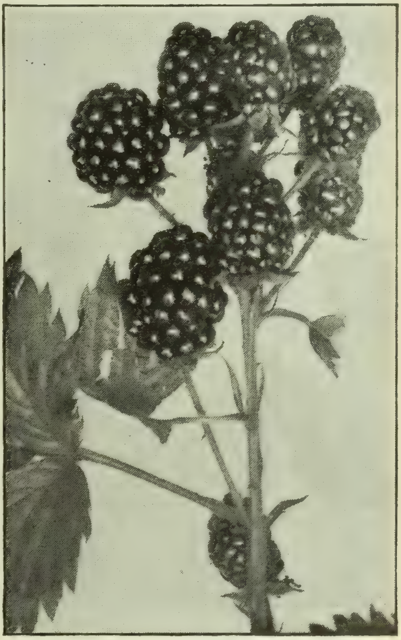

FIG. 23.— *Mersereau*

PLANTING

Time.— In the East, spring planting is generally preferred to fall planting, provided it can be done early enough. In case the pressure of other farm work renders an early start impossible, it is better to set out the plants in the fall. This should be done late enough, however, to prevent the young shoots from developing; otherwise, the frost is likely to injure them severely. In the districts of western New York in which a fruit survey has been made by the College of Agriculture, spring planting is practically universal. In the prairie States of the Middle West the winter winds are very strong, and berries often suffer more from lack of moisture than from freezing. Under such circumstances it is better to set out plants in spring and thus avoid the risk of drought for young bushes, the roots of which have not yet established a wide feeding area. It is the opinion of growers, however, that fall planting with a protective mulch of manure is preferable to late spring planting; if properly conducted, neither method should fail. Strong one-year-old suckers are the best to plant and they should be set somewhat deeper than they originally grew.

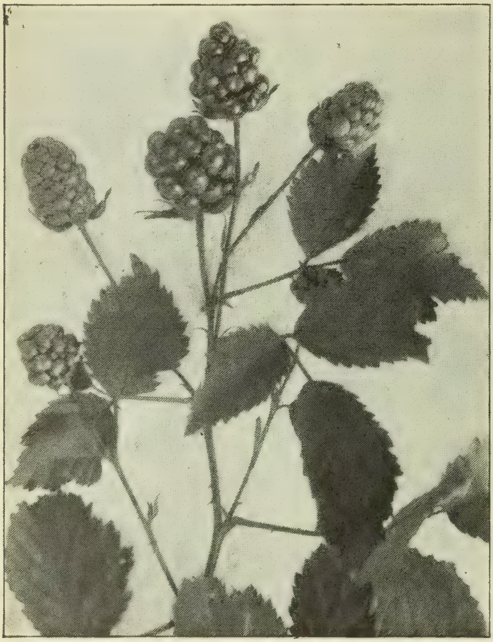

FIG. 24.— *Rathbun*

Method. — In starting a new plantation it is important to choose the best method for planting. The habits of growth and the characteristics of the varieties influence such a choice. It is necessary to employ every means for obtaining larger, more palatable, and more perfect fruit. The common mistake is to set the plants too close. Many berry patches are yielding small crops of unsatisfactory fruit because they are overcrowded and cannot be properly cultivated. Moreover, cramped conditions provide excellent breeding-places for insects and increase the danger of injury from frosts and fungous diseases. The blackberry requires a large amount of space because it has a dense, thorny growth, which spreads rapidly. There are two general methods of planting:

1. Continuous rows.— According to this method, which formerly was exclusively used, the plants are set in rows six to nine feet apart, with the bushes two to three feet apart in the rows. Although this plan is a marked improvement over a crowded condition in the rows, it permits cultivation in one direction only. Small growers generally prefer it because it lends itself to intensive cultivation and to heavy fertilization.

2. Hills.— Some large growers favor the hill system, according to which the plants are set about five or six feet apart in each direction. Although this arrangement reduces the number of plants per acre, the improved quality of the fruit probably compensates for the decrease in quantity. An important advantage of this system is the possibility of cultivating crosswise of the rows as well as lengthwise, in which case all cultivation can be done with the horse cultivator. By this method, also, the maximum amount of sunlight is obtained for the development of large fruit buds and a good quality of fruit. Furthermore, the work of pruning, spraying, and picking can be done more conveniently and economically.

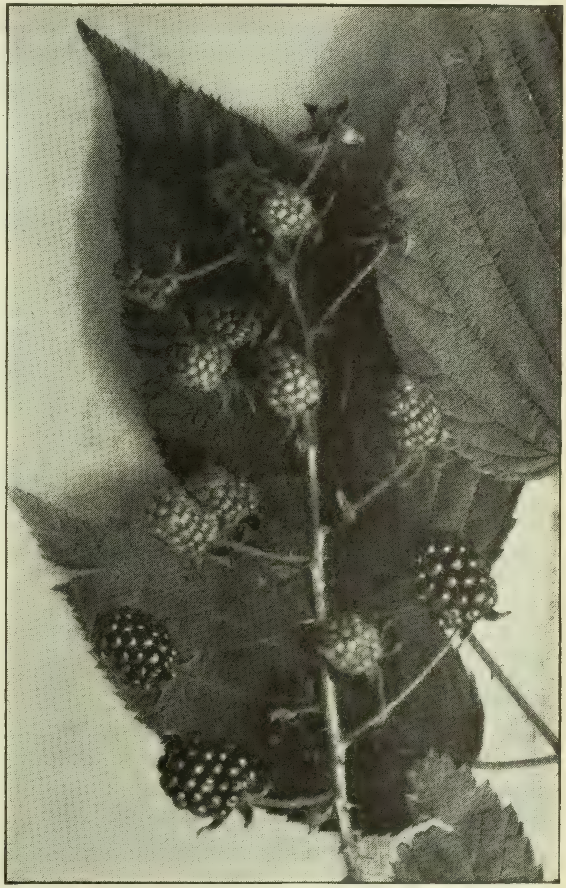

FIG. 25.— *Snyder*

In favor of the hill system, one of the most enterprising fruit-growers in the country — J. H. Hale * of Connecticut — says: "I have seen the largest yield in quarts, the finest fruit, and the most satisfactory results, from planting blackberries in hills seven to 'eight feet apart each way."

TILLAGE

Growers agree that clean culture is the best treatment for the blackberry patch. Nothing can take the place of good tillage. In fact, intensive cultivation is necessary in order to maintain a dust mulch that will conserve the maximum amount of moisture until the fruit is harvested. The early droughts of summer often cause a serious decrease in the yield of fruit.

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* F. W. Card. Bush fruits, p. 113.

Cultivation should be of such a nature as to destroy the suckers which spring up between the rows and which, if allowed to remain, rob the bearing plants of moisture and plant-food. It should be remembered, however, that the roots of the blackberry plant are near the surface of the ground, and hence tillage should be shallow. The general practice is to cultivate the patch every two weeks until the fruit ripens, although care should be taken not to disturb the plants when in full bloom. Cover crops have not been used extensively between the rows, but there is no reason why they are not practicable and desirable. Crimson clover is probably the best cover crop for a blackberry patch, especially if the soil is fine and in good condition.

The benefits of intensive cultivation are clearly shown in the results of the surveys that have been made of the patches in western New York. When the table indicates that the plow has been used, its use has been mainly for the purpose of destroying the suckers that sprang up between the rows:

TABLE 1. RESULTS OF DIFFERENT DEGREES OF CULTIVATION

Treatment	Farms	Acres	Average quarts per acre	Average income per acre
Intensive cultivation	9	14.65	1,890.64	$244.65
Plowing plus cultivation	8	14.83	1,766.55	153.46
Moderate cultivation	5	2.58	1,032.55	92.45

Sometimes a mulch is recommended as a substitute for tillage in the blackberry patch. There are the same objections to this practice in the blackberry patch as there are in the fruit orchard. Mulch in sufficient quantities is difficult to obtain, and even when sufficient quantities are available its use is often too expensive. In the home garden, where tillage is either inconvenient or impossible, a mulch may be resorted to, but in the commercial blackberry patch it is seldom advisable.

FERTILIZATION

Growers unanimously testify to the marked benefits resulting from the use of fertilizers. However fertile a soil may be in the beginning, it becomes more or less depleted in time and has to be improved by the application of fertilizer in moderate quantities. Thorough preparation of the soil before the plants are set will render plant-food available, and the annual application of humus in the form either of stable manure or of green-manure crops will aid in this process. Commercial fertilizers should not be used until thorough cultivation and stable manure have been tried and have failed to give the desired growth. As a source of potash and phosphoric acid, however, they may be necessary; in this case, wood ashes, sulfate of potash, acid phosphate, or basic slag may be applied according to the condition and the needs of the soil. Nitrogen should not be too abundant, as it will produce a rampant growth of immature and unfruitful branches that are subject to winterkilling.

The question of fertilizers for a blackberry patch is well summarized by F. W. Card in his book called "Bush Fruits." The quotation given below is found on page 108:

> The following statement from O. B. Galusha, as reported in the Transactions of the Illinois Horticultural Society for 1880, is worthy of careful consideration: "A generous feeding of the soil is amply repaid in liberal crops of fruit. In my older plantation, the soil was equally manured throughout and yet on one side it is naturally considerably richer than the other, and this side produces fully one third more fruit than the other." This same principle will be found to apply with equal satisfaction to ordinary soils throughout the country, as a whole. If properly managed and pruned, the plants will be able to transform a large amount of plant-food into luscious berries and laughing dollars. Heavy applications of stable manure to young plants, which have not yet sufficient wood to carry full crops, may work injury, especially if on strong, moist soils. On soils of this character, nothing is needed until the plants are in full bearing. If additional plant-food is then desirable, commercial fertilizers, with a liberal proportion of potash, may better fill the need.

In western New York the best growers agree that it is economy to apply a fertilizer after the plants begin to bear. This fertilizer may be stable manure only, or commercial fertilizer, or both. The results that these growers have obtained are summarized in the following table:*

TABLE 2. RESULTS OBTAINED ON FARMS IN WESTERN NEW YORK

Treatment	Farms		Acres		Quarts per acre		Income per acre	
	1909	1910	1909	1910	1909	1910	1909	1910
Manure or commercial fertilizer..........	7	9	12.11	22.15	3,350.6	1,910.74	$233.99	$219.44
No manure nor commercial fertilizer....	5	11	4.91	10.41	2,379.6	1,684.72	170.69	136.74

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* Too much reliance should not be placed on these figures, because it was impossible to obtain accurate information from a sufficient number of patches to give reliable averages.

PRUNING

The pruning of the blackberry is a comparatively simple operation, provided the life habit of the plant is clearly understood. New canes start in spring and develop during summer, usually reaching a height of four or five feet. They spring from roots that are spread out horizontally a few inches below the surface of the ground. In the case of many varieties, lateral branches develop. During the second summer the canes produce fruit and die. The root system lasts for twelve to fifteen years, whereas the canes are biennial, or live but two years.

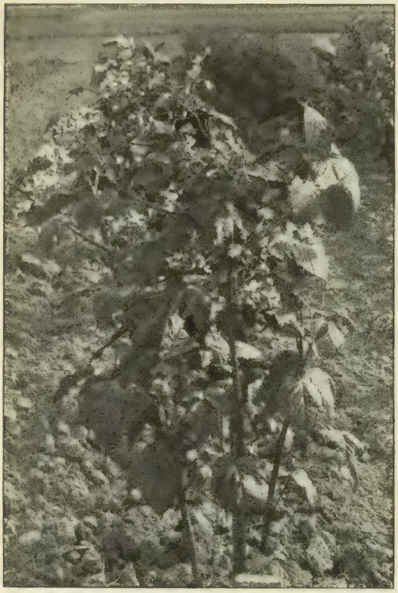

FIG. 26.— *A row of blackberries showing proper pruning*

For the purpose of discussion the pruning of the blackberry may be divided into three parts, according to the season of the year at which the work is done:

Removal of dead wood.— As soon as possible after the fruit is picked, the old canes on which it was borne should be cut out and burned. This old wood is of no value to the plant and its removal permits the young canes to grow without obstruction. Moreover, old canes are likely to harbor insects and fungous diseases that should be destroyed. The only advantage to be obtained in leaving the old canes would be the protection of the new canes against winter weather, but in New York State little damage is done by the snow in breaking the bushes.

Summer pruning.— The tops of the new canes throughout the patch should be carefully pinched off when they have reached a height of eighteen inches to two feet. The removal of the tip of the cane causes lateral branches to develop and produces a stocky growth. Since the new canes do not reach this height at the same time, it is necessary to go over the field at frequent intervals. If the young shoots are allowed to go beyond the desired height before they are cut back, growth will be checked and the buds will be weakened. Moreover, pruning that is done too late in the summer may induce late growth in the fall, thus delaying the maturity of the plant and rendering the wood less resistant to winterkilling.

Spring pruning of the laterals.— While the heading-in of lateral branches is a common practice, it is not followed by all growers. Probably insufficient knowledge of the fruiting habits of different varieties hinders some men from heading-in blackberry bushes in the spring. For success in this operation, considerable practical experience with different varieties is necessary. Varieties differ as to the position of the fruit buds on the laterals: some fruit buds may appear near the tip, others near the center, and others toward the base of the plant. Unless one is familiar with the fruiting habit of each variety, it is difficult to know just how far each should be headed-in. Certain growers omit the work altogether; others wait until the blossoms appear, at which time the exact position of the fruit buds can be determined.

A study of thirty-one patches was recently made in western New York. The owners of twelve of these patches practiced spring pruning. A comparison of the yields of patches where the laterals were headed-in, with patches where this work was not done, seems to indicate that in spring heading-in is not necessary and that good crops are produced without it.

The table below gives comparative yields and incomes for the two methods of treatment:*

TABLE 3. RESULTS OF DIFFERENT METHODS OF PRUNING

Treatment	Farms	Acres	Quarts per acre	Income per acre
Summer pruning only..................	13	18.33	2,028	$222.28
Summer pruning and spring pruning.....	8	14.73	1,733	144.96

DISEASES OF BLACKBERRIES

Since the diseases of the blackberry are the same as the diseases of the raspberry, which have been discussed in Reading-Course Lesson Vol. II, No. 36 — Culture of Red and Black Raspberries and of Purple-cane Varieties, pages 124 to 127 inclusive — the following descriptions have been copied in large part from that publication:

Anthracnose

This disease first makes its appearance when the young shoots are twelve to fifteen inches in length, and is recognized by the brownish or purplish patches or depressions on the young shoots and leaf stalks. As the shoots grow the blotches become larger and grayish in the center, and by the end of the season may encircle the cane and practically girdle it.

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* In each case the number of farms differs from those mentioned in Table 2, because definite information was not available in some instances.

Control.— Eradication is the best method of control. All the old canes, and the new ones that are badly diseased, should be cut out and burned as soon as the fruit is gathered. Applications of bordeaux, 5-5-50, will control the malady, but this treatment may not be profitable. If spraying seems advisable the first application should be made when the new canes are six to eight inches high. The second and third applications should be made at intervals of ten to fourteen days.*

The grower should be careful to plant new patches where the disease is not prevalent. The departments of Pomology and Plant Pathology of the New York State College of Agriculture at Cornell University are now studying cooperatively different spraying mixtures for controlling this disease.

Cane blight, or cane wilt

This disease affects both red and black varieties. It is caused by a fungus that attacks the cane at some point and kills the bark and the wood. That part of the fruit cane above the diseased area suddenly wilts and dies. No successful method of treatment is known. It will help greatly in the control of the disease if the fruit canes are cut and burned as soon as the fruit is gathered. In making new settings the grower should use only plants from healthy patches.

Crown gall, or root knot

This is a bacterial disease that is more destructive to raspberries than to blackberries. It is detected by the large, irregular knots on the roots and at the crown underground. The disease is contagious.

Control.— The grower should avoid planting on infested land, and should never set plants showing the root knots. Other than these two precautions, no effective method of treatment is known.

Red rust

The fungous disease known as red rust, or yellows, is often serious. In some sections of New York it has made the crop unprofitable, whereas in other sections it is not found at all.

Control.— As soon as the disease appears in the patch the affected plants should be dug up and burned immediately, all the roots being carefully removed. If the disease is to be successfully checked this method of eradication must be carefully carried out.

INSECTS INJURIOUS TO BLACKBERRIES

There are no serious insect pests of the blackberry in western New York. The cane-borer, which is the most troublesome, is discussed in

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*New York (Geneva) Agricultural Experiment Station. Bulletin No. 124.

Reading-Course Lesson Vol. II, No. 36 — The Culture of Red and Black Raspberries and of Purple-cane Varieties — as follows:

Cane-borer

The adult is a slender beetle, with black wing covers and a yellow thorax. In laying her eggs the female girdles the tip of the cane with rings of punctures. These rings are separated from one another by about an inch. Between the rings the female pierces the cane and forces into it a long, light-colored egg. Immediately after this girdling, the tip of the cane droops and soon dies. The egg hatches in a few days and the young larva burrows down the center of the stem, consuming the pith. The larva passes the first winter in its burrow not far from where the egg was deposited, and by the second fall reaches the root, where it passes the winter and changes into a pupa the next spring. The beetles escape from their burrows in June, at which time they may be found on the bushes.

Control.— Soon after the female punctures the cane at the point where the eggs are deposited, withering and drooping of the tip is conspicuous. As soon as this is noticed the cane should be cut off well below the injury, so that there will be no danger of leaving the grubs, which may have hatched before the injury is noticed.

HARVESTING AND MARKETING

Considerable care should be exercised in the harvesting of the blackberry if the best results are to be obtained. Unless the fruit is allowed to mature on the bush it is likely to be unpalatable. Certain varieties of the cultivated fruit have the unfortunate characteristic of turning black before they are fully ripe, and if marketed in this condition they will soon acquire a poor reputation. The grower should give particular attention to this matter and should ship only fruit that will be in good condition when it is received by the consumer.

The proper time for picking depends on the distance of the place to which fruit is to be shipped. If the fruit is to be disposed of locally, the berries may be left on the bushes until they are thoroughly ripened; but for long-distance shipments they must be picked when firm, even at a sacrifice in quality. Markets that are not far distant, therefore, are most desirable for this fruit.

The operation of picking is very simple. The fruit is easily gathered, and since the berries are large they fill the baskets rapidly. Picking is often done by women and children who are paid about one and one half cent a quart. The prospective berry-grower should be sure that sufficient pickers are available in his locality. Large growers often import pickers from neighboring cities. The bushes should be picked clean each time that they are gone over, and all overripe fruit should be removed from the bushes and either placed in a separate basket or thrown on the ground. For convenience, the picker may carry a tray that holds eight or ten quart baskets. The fruit should be placed in the shade immediately after picking, because the hot rays of the sun will turn it red, thus rendering it unattractive in appearance and disagreeable in flavor. The work of sorting and grading is done as the fruit is picked, but the baskets should be inspected when delivered by the pickers. Only clean and perfect fruit should be marketed.

The blackberry is marketed almost entirely in pint and quart boxes. The latter package is used exclusively in western New York. The boxes are placed in carriers holding twenty-four to thirty-two quart boxes. In the blackberry districts most of the fruit is disposed of through local dealers, a part is assigned to commission merchants, and the remainder is sold directly to the consumer. Each of these systems of marketing has its advantages and disadvantages, and every grower must determine for himself which system is best suited to his particular conditions.

YIELDS AND INCOMES

The blackberry is one of the heaviest yielders of the bush fruits. The Farm and Garden Rule Book, by L. H. Bailey (page 126), gives the average crop of blackberries as fifty to one hundred bushels per acre, which, at thirty-two quarts per bushel, is sixteen hundred to thirty-two hundred quarts. The average yield for western New York in 1909 was 3132.07 quarts per acre, and in 1910 it was 1490.6 quarts per acre.

The table below summarizes the surveys of the patches in western New York. The figures indicate the yields and returns that may be expected from a commercial patch of blackberries:

TABLE 4. SUMMARY OF SURVEYS IN WESTERN NEW YORK

	1909	1910
Farms	13	30
Total acreage	17.43 acres	51.31 acres
Average acreage per farm	1.34 acres	1.71 acres
Average yield per acre	3,132.07 quarts	1,490.6 quarts
Average yield per farm	4,245.53 quarts	2,549.5 quarts
Average income per acre	$222.42	$135.14
Average income per farm	$298.22	$231.135
Highest price per quart	....	.12
Lowest price per quart	....	.06
Average price per quart	....	.0887

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE
NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
ENTERED AS SECOND CLASS MATTER AT THE POST OFFICE AT ITHACA, NEW YORK
W. A. STOCKING, JR., *Acting Director* A. R. MANN, *General Editor*
COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 52 NOVEMBER 15, 1913 FRUIT-GROWING SERIES No. 5

CULTURE OF THE BLACKBERRY

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if information is requested.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT-GROWING, FARM CROPS, STOCK-FEEDING, VEGETABLE-GARDENING, PLANT-BREEDING. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent one at a time, on the return of discussion papers. *Persons who wish to receive the other lessons in this series should therefore sign and return this discussion paper whether the questions are answered or not.* The Reading-Course will endeavor to aid in the solution of farm problems and in the organization of study clubs, and to give references for advanced study. *The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested in the course.*

1. If a grower wishes to enlarge his blackberry patch by setting additional plants of the same varieties, how should he proceed?

2. Compare the method of propagation for the blackberry with the methods of propagation which are commonly practiced for the other bush fruits.

3. Name the important commercial varieties of the blackberry and state which of these varieties are of recent origin.

4. Which of the above-mentioned varieties succeed best in your section?

5. Does the pruning of the blackberry differ from that of the other bush fruits?

6. For the home garden would you prefer to cultivate or to mulch the blackberry (or any bush fruit)? State your reasons for this choice.

7. What are the most serious diseases and insect pests of the blackberry and how are they controlled?

8. What is your opinion of the commercial possibilities of the blackberry in your section?

Name..

Address..

Date..

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

W. A. STOCKING, JR., *Acting Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 54 DECEMBER 15, 1913 DAIRYING SERIES No. 3

THE DAIRY HERD

HENRY H. WING

THE products of the dairy cow are fourfold: The first and chief product is naturally the milk which she secretes, and which is used as milk or for butter- or cheese-making. The second product is the calves which she bears, and which may be of more or less value.

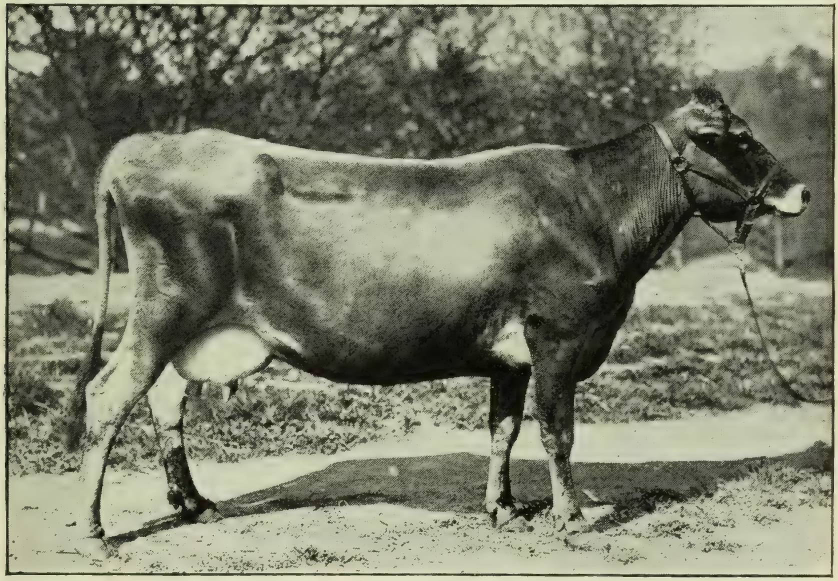

FIG. 27.— *Showing a well-formed udder, with well-placed teats. Compare with Fig. 28*

Third, the carcass of beef which she will yield when she is no longer useful for the production of milk should be taken into account. Lastly, the manure she produces is of considerable value.

We may call the milk the main product, and the calves, beef, and manure the by-products, of the dairy cow. It has been asserted that the milk is the only product that should be taken into consideration in estimating the value of a dairy cow, and that the calves and beef should be entirely ignored by a successful dairyman; but in these days of strong competition it is not possible to ignore the by-products, and in any scheme of successful dairying the calves and beef must at least be taken into consideration. This does not mean that in any case milk-producing qualities are to be sacrificed for the sake of the by-products. It simply means that of two animals of equal value for the production of milk, the one that will give the greater return in production of calves and value of carcass is the more profitable.

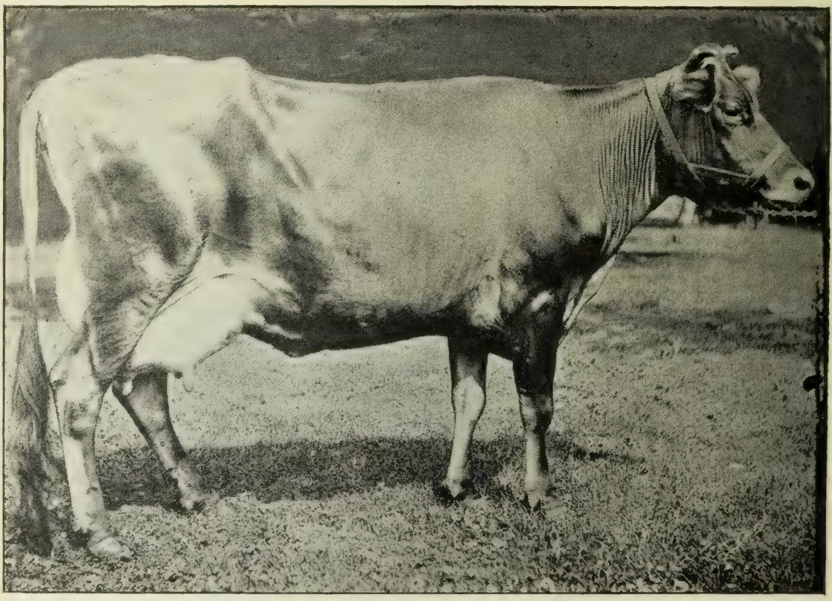

FIG. 28.— *Showing the spare, angular, wedge-shaped form desirable in a dairy cow. Compare with Fig. 29. Teats well placed*

THE SELECTION OF THE HERD

There is no one best breed of dairy cows.— In the formation of a dairy herd one of the first questions to be considered is the choice of a breed and whether the herd shall be made up of pure-bred or grade animals. There are several well-known breeds of dairy cattle in the United States, each having distinct qualities and each having strong partisans. While, undoubtedly, some breeds are better fitted for certain conditions of soil and climate than are others, still the matter of the choice of a breed may well be left to individual preference. In almost any location one may choose a breed for which he has a strong liking, either real or fancied, and be assured that he can establish with it a successful herd. Jerseys, Guernseys, Holsteins, Ayrshires, Swiss, Devons, Redpolls, and even Shorthorns make a varied and fairly long list of breeds from which to select.

The comparative merits of pure-bred and grade cows.— Whether pure-bred or grade animals should be selected is a matter upon which there may be more difference of opinion. By purely bred animals are meant those that are recorded in the herdbooks of their respective breeds. This is the narrow, restricted sense of the term "pure-bred," but it is the one in common use in this country. A grade animal is the produce of a pure-bred sire upon a common, or grade, dam. The produce of a pure-bred sire and a common, or "scrub," dam is called a half blood; the produce of a pure-bred sire and a half-blood dam is called a three-quarters blood; a three-quarters blood bred in turn to a pure-bred sire will produce a seven-eighths blood; and so on *ad infinitum*. Since only the offspring of pure-bred parents on both sides are eligible to registry in the herdbooks of any of our dairy breeds, it follows that, no matter how far the process of grading up by the use of pure-bred sires on grade females is carried, pure-breds, in the technical sense, can never be produced. Since pure-bred animals are sought after for breeding purposes, the offspring of pure-bred animals are therefore more valuable and command a higher

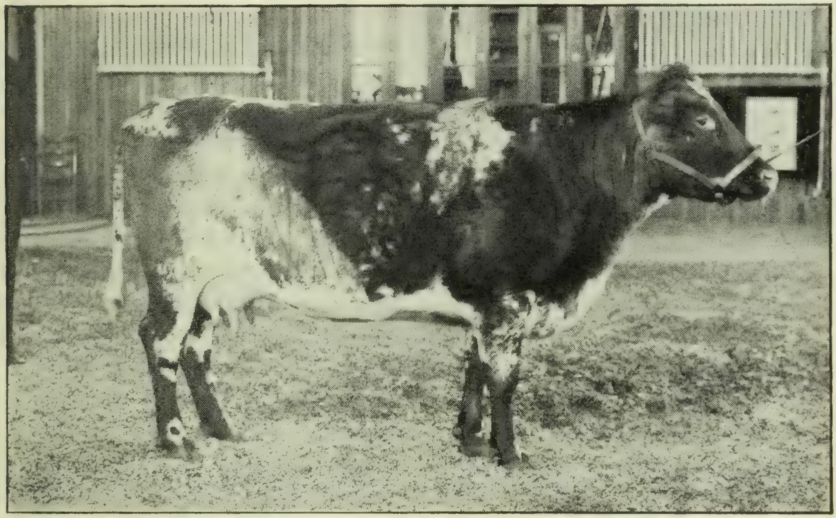

FIG. 29.— *The square, beefy type of cow, usually a poor milker. Compare with Fig. 28. Note poorly placed teats*

price than the offspring of grades. Hence, if the value of the calves is taken into consideration, a pure-bred herd is a more productive one, other things being equal, than a grade herd. On the other hand, by the grading-up process above referred to, continually selecting the cows that are the best producers, it is entirely possible and by no means difficult to establish a herd of grade cows that will equal in the production of milk any herd of pure-bred animals. Hence, if the main product alone is sought after, a grade herd may produce as largely as a pure-bred one; but if the by-products are to be taken into consideration, as it was stated at the outset that they should be, a pure-bred herd certainly has an advantage over a grade herd of equal productive capacity.

Maintaining the herd.— A dairy herd may be maintained in two ways. First, by continued purchase of mature animals to replace those whose period of usefulness has passed. There are many conditions under which this may be a wise practice. If it is desirable to have the whole herd composed of cows in their full productive capacity; if there is abundant opportunity for selection and purchase near at hand; if there is a reasonably good market for cows that are undesirable; and if one has reasonable skill in selecting and good ability in bargaining — a herd of high productive capacity may be more easily and more cheaply maintained in this way than by attempting to raise young animals to replace those that are worn out.

The other method of maintaining the herd is, of course, by raising calves to supply the place of old cows that are no longer profitable. Such a herd will always contain a considerable number of young animals that have not yet reached full development, and therefore such a herd will seldom equal in average production per animal a herd that is maintained wholly by purchase. At the same time a greater degree of uniformity of type may be maintained where the animals are raised. If land is abundant and cheap, the cost of raising a heifer, up to the time that she becomes a fully developed cow, will be less than that of purchasing a similar animal outright. Through force of circumstances, by far the greater number of dairymen must rely on raising the calves necessary to maintain the herd. This being the case, the ordinary dairyman will need to provide himself with the services of a bull suitable to produce useful dairy cows. In most cases he will need to own this bull, so that the question of the selection and care of the breeding bull has an important bearing upon the maintenance of the dairy herd.

The selection of the breeding bull.— It goes without question that such a bull should be purely bred. There are still far too many immature and ill-bred bulls in use. As a matter of convenience, a yearling bull is turned with the herd about the first of June, and in the course of two or three months, when all or nearly all of the cows have become pregnant and he has fattened up, he is sold again at a price little, if any, below his cost, and the dairyman is without the trouble of the care of a bull for several months. If, in addition to this, little attention is paid to the breeding of the bull, it is easily seen that little, if any, improvement in the character of the herd can be expected from his offspring. The progeny that a bull has already produced is by far the best index of his usefulness that a prospective purchaser can have. Cattle do not reach full maturity, in either sex, until they are about four or five years old. Consequently the best bull to select is a bull not less than four years old that has already begot cows of a high productive capacity. Such a bull is, of course, more difficult to control and more expensive to keep, but he is worth many times the trouble and expense as compared with an immature yearling.

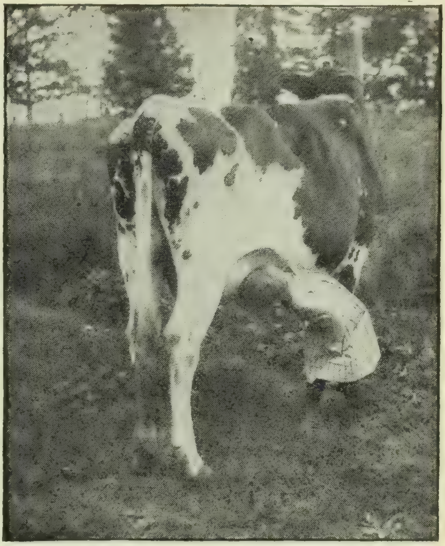
FIG. 30.—*A poorly formed udder, not reaching high up in the rear. Compare with Fig. 31*

In the selection of a bull, much has been made of various so-called milk signs: rudimentary teats, milk veins, escutcheon, etc. While each and all of these may be of some value, they are by no means to be set against the record that a bull has made in the production of his daughters. Other personal characteristics of the bull that indicate vigor of constitution, good digestive organs, and vital activities in general, are a loose, mellow hide, a bold, bright eye, an active gait and disposition. These are of great importance as indicating capacity to reproduce similar characteristics in his offspring.

The management of a breeding bull.— The management of a bull on a dairy farm is often a matter of a good deal of trouble and perplexity. In a herd of ordinary size a single bull is sufficient, and it is usually necessary that he be kept from the herd during the greater part of the year. This means that he must be kept in solitary confinement. The result of this is, too often, that his temper becomes uncertain and his breeding powers impaired from lack of exercise. In all cases where it is possible to do so, it is better that the bull should run with the herd of cows. With a little care this can frequently be done, particularly during the summer and fall, when the cows are all pregnant in a spring calving herd, and in the spring and early summer, when the cows are all pregnant in a fall calving herd.

The powers and temper of a bull may also be safeguarded by giving him exercise on a tread power, or hitched by a long rope or chain to a wire between two upright posts, or attached to a pole balanced upon a post so that he may move around it. Occasionally, also, the labor of a bull may be utilized upon a tread power for cutting feed, pumping water, or separating milk. Sometimes a particularly handy owner will break a bull to work to harness or in a cart. It may even be time and labor well spent to give a bull walking exercise. A good, vigorous animal, carefully kept, should retain his breeding powers up to eight or nine years of age, or even beyond.

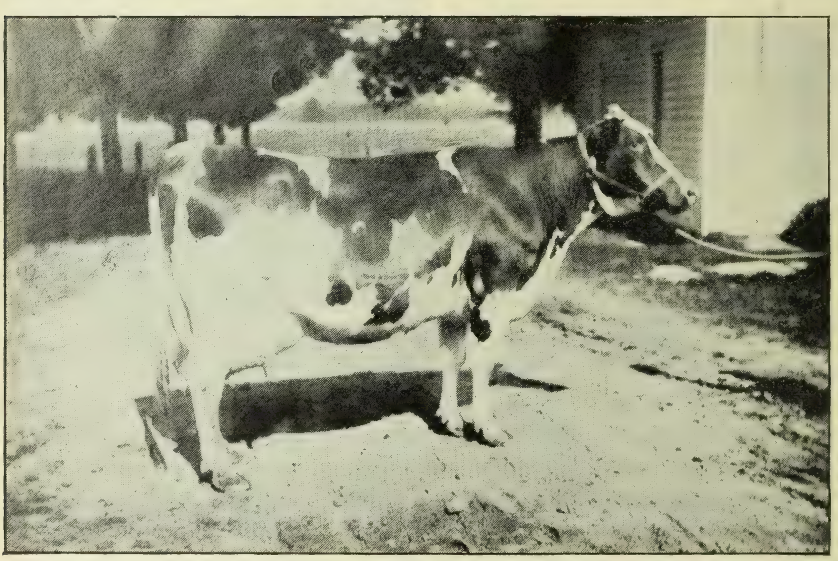

FIG. 31.— *A well-formed udder, reaching high up. Compare with Fig. 30*

Weeding out the scrubs.— According to the census of 1910 the production of the 1,509,594 cows in New York State amounted to 6,657,309,540 pounds of milk, or 4,410 pounds per cow. This indicates that the average cow of the State of New York is of little or no profit to her owner.

In order to determine whether or not the average cow is profitable to her owner, it is necessary to make a calculation of the value of her product and the cost of maintenance for a year. Lacking accurate data for a large number of individuals, such a calculation must be largely in the nature of an estimate, and it is governed to a considerable extent by local market fluctuations in prices of food and dairy products. The following is therefore given only as an estimate, to be varied in any respect as particular conditions seem to warrant. In other words, it merely gives a basis for any estimate that an individual dairyman may see fit to make in regard to his own herd.

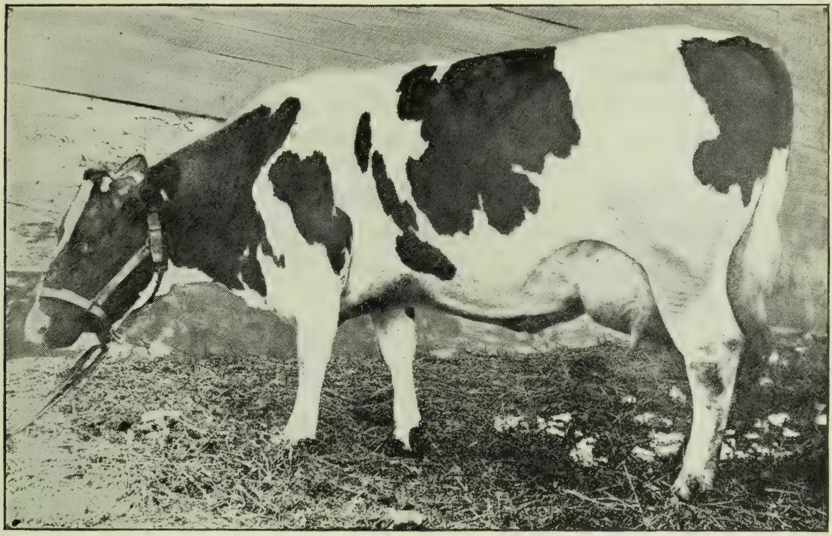

FIG. 32.— *The prominent milk veins of this cow would incline us to believe her to be of a good dairy type, if we had no better way of judging her*

VALUE OF PRODUCTS FROM THE AVERAGE DAIRY COW IN NEW YORK STATE

4,410 lbs. milk at $1.50 per 100 lbs.	$66.15
4,410 lbs. milk (3.8 per cent fat plus $\frac{1}{6}$) = 195.5 lbs. butter, at 35 cents	68.43
4,410 lbs. milk (9 lbs. milk for 1 lb. cheese) = 490 lbs. cheese, at 13 cents	63.70
Average	$66.09

COST OF FOOD AND MAINTENANCE

26 weeks pasture at 30 cents	$ 7.80
40 lbs. silage per day for 180 days at $3.50 per ton	12.60
10 lbs. hay per day for 180 days at $12 per ton	10.80
1,470 lbs. grain at $30 per ton	22.05
(1 lb. of grain for each 3 lbs. of milk, or 7 lbs. per day for 7 months)	
Cost of food	$53.25

Depreciation, $25 in five years, per year	$ 5.00
Interest on investment, $60 per cow at 6 per cent	3.60
Balance available to pay for labor	4.24
Total	$66.09

From this estimate it appears that the owner of the average dairy cow will have about $4.25 to pay for labor. Whether or not this is a sufficient amount, each owner must determine for himself. On the basis that it would require the entire labor of one man to feed, care for, and milk twenty cows, it would mean a labor return of only $85 for the year, which is far below the lowest wage paid to ordinary farm labor.

The first problem, then, of the successful dairyman is to separate the poor cows from the good ones. There is no means of determining the difference between a good and a poor cow except by keeping a record of her production. The knowledge of what a cow has already produced is of far greater usefulness as indicating what she is likely to produce in the future than any correspondence of her outward form with any standard, no matter how carefully the standard is devised or how skillfully she is judged upon it. The successful dairyman, then, keeps careful records of the production of his cows and bases his selection upon them. Since fat is by far the most valuable constituent of milk, the usefulness of a cow is largely indicated by the number of pounds of fat that she produces in any given period of time. The number of pounds of fat that a cow produces is readily determined by knowing the number of pounds of milk and the percentage of fat that it contains.

In order to obtain a complete record of a cow, it is necessary that the milk be weighed and the fat determined at regular intervals. In determining the production of a cow the record may be complete or incomplete. A complete record requires a greater expenditure of time, labor, and care, but it gives an absolute record of the production. An incomplete record, requiring considerably less time, labor, and care, may enable one to make an estimate of the production that shall be nearly or quite as valuable as an absolute record. The most perfect record is made by weighing and recording each milking, taking at the same time a small sample which is kept in a common receptacle during the period of a week, after which the fat is determined by the Babcock method. If this is too much trouble, the milk may be weighed at each milking and the fat determined in the milk of a single day at intervals of a month. This method has been shown to give results that are sufficiently accurate for all practical purposes.

Judging a dairy cow.— The regular use of the milk scales and the Babcock test is an indispensable part of the labor of the modern, progressive, successful dairyman. Still there are many occasions when it is desirable or necessary to form some estimate of the qualities of a cow where the information given by the scales and Babcock test is lacking. There are certain characteristics of form which more or less certainly indicate the capacity of a dairy cow. Many become so skillful in recognizing these characteristics that they are able to separate good from poor cows to a highly useful degree. A knowledge of these characteristics is indispensable to a skillful dairyman.

It is generally recognized that a cow should be wedge-shaped, that is, the skeleton of the hinder portions of the body should be distinctly more largely developed than that of the forward portions. She should stand from half an inch to an inch and a half higher at the hips than at the shoulders. The width, as viewed from the front, should be distinctly wider behind than before, and the depth of the body as viewed from the side should be distinctly greater behind than before.

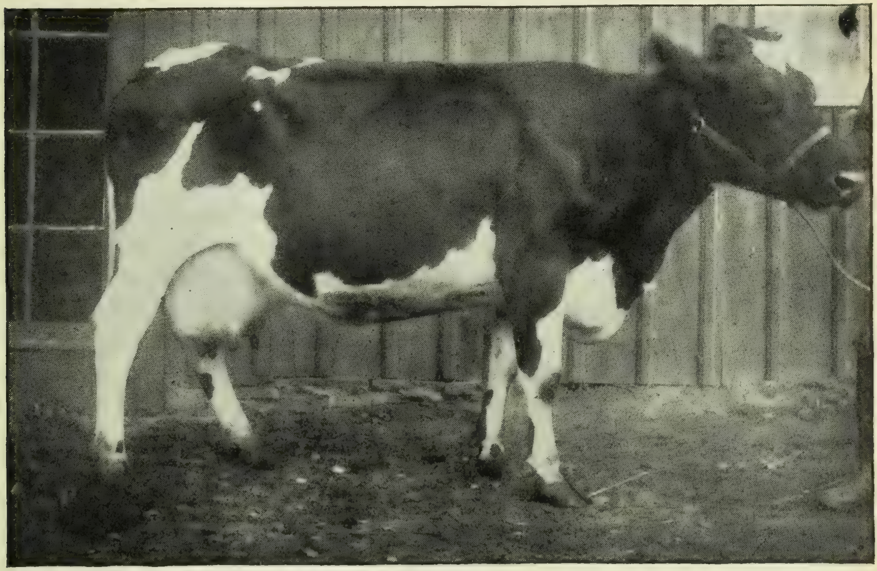

FIG. 33.— *An excellent three-quarters-bred cow, showing what a pure-bred sire can do in two generations. The grandmother of this cow was a rather poor milker. She herself produced in nine years, beginning when she was two years old, 96,800 pounds of milk and 3814 pounds of butter*

In order to produce large quantities of milk the dairy cow must also have vigorous powers of respiration and circulation. Since milk is formed from the blood, vigorous circulation is required to carry the blood in large quantities to the udder, and particularly to the minute capillaries. Vigorous powers of respiration are necessary to purify the large quantities of blood which must pass through the lungs. Vigor of respiration is indicated by a large, deep, full chest, particularly wide upon the floor; and by large, clean, open air passages, particularly the nostrils and throat. Vigor of circulation is indicated by prominent exterior blood-vessels and by bright, pink complexion of the thinner portions of the skin and visible mucous membranes.

In order to secrete large amounts of milk, a cow must digest and assimilate large quantities of food. She must therefore have large powers of digestion, assimilation, and secretion. Capacity to digest is indicated to a certain extent by the size of the digestive organs, since a large part of the cow's food is bulky and she must have capacity to take in large amounts of food in a short time. Vigor of assimilation and secretion is seen in the abundance and healthy condition of the hair, and in the softness and pliability of the skin and the abundance of secretion from it.

Good points in the udder.— More useful than any other outward characteristics of the cow, as indicating her capacity to secrete, is the size and condition of the udder. Naturally a useful cow must have a large udder, and, from the æsthetic point of view, the more regular in form it is, the better. The actual size and capacity of the udder, however, may not be indicated by its apparent size. In some animals the udder is held so close to the walls of the abdomen and so great a part of it is hidden between the legs that it may appear smaller than an udder of the same size, or even smaller, that is more pendulous. So, too, in judging of the quality of an udder its so-called fleshiness must be taken into consideration; that is to say, in some udders the connective and fatty tissue is so much more abundant that it occupies room that would otherwise be occupied by true milk-secreting follicles. Such an udder will be tense and firm, especially when empty, and will have little secreting capacity in comparison with its size. A so-called fleshy udder is approximately of the same size when empty as when full. An udder in which the greater part of the tissue is made up of milk ducts and secreting follicles will shrink rapidly as the milk is drawn from it, and when empty will be particularly loose, pliable, and flexible.

Popular milk signs.— In the cow, as in the bull, there is a considerable number of so-called " milk signs " that are relied upon more or less implicitly by various people in judging or selecting cows. Foremost among these are the so-called milk veins. These milk veins never by any possibility contain milk, but form a system of exterior veins on the lower part of the abdomen that serves to convey a part of the blood from the udder back toward the heart. They vary in size, in length, in sinuousness, and in simplicity or multiplicity of branches. Inasmuch as their size indicates, to a certain extent, the amount of blood circulating in them, they may be considered as useful signs. The larger the veins, naturally, the larger the amount of blood flowing through them. A cow with a large, elastic, tortuous, and branching milk vein is likely to be a better cow than one less well-developed in this respect. However, the milk veins cannot be relied upon implicitly as indicating the capacity of an animal to produce.

The milk veins usually enter the abdomen by one or more distinct perforations on each side, called milk wells or holes. A large perforation offers less obstruction to the vein and so impedes the circulation less, and to that extent is a useful sign; but to judge between the merits of two cows merely upon differences in the size of milk wells is to carry the matter much too far.

It is now scarcely necessary to more than mention the milk mirror, or escutcheon, as the area of up-growing hair upon the rear of the udder, thighs, and perineum is called. Variations in the size and shape of this area were seized upon by the French writer, Guenon, as indicating the amount and duration of milk secretion. Upon these variations he constructed an elaborate table, showing the amount of milk that a cow possessing an escutcheon of a certain size and shape would give. Guenon had a large following for many years in this country, but at the present time scarcely any attention is given to the escutcheon.

It has been observed that an animal in which the joints of the skeleton are not too closely knit is likely to have good powers of assimilation. This has been seized upon by those who consider what is known as the " open organization," as indicating great capacity to secrete. This loose-jointedness, or open organization, is well indicated by the distance between the vertebræ in the spinal column, so that the open, or loose, chine is taken to indicate good capacity to secrete. Doubtless it is of more or less value, but there are many animals that are highly satisfactory as producers that are not at all remarkable for looseness of chine, or " open organization."

The size of the umbilicus is also taken as an indication of the capacity of the animal to give milk. The argument of some is that a large umbilicus indicates that the umbilical cord in the fetus was large and the fetal circulation strong; and that such an animal, being strongly nourished in the womb by its mother, has thereby a stronger constitution than one with a small umbilicus. Careful observation has shown, however, that the size of the umbilicus is more of a breed than an individual characteristic.

There is a cord or fibrous band in the flank that varies in prominence and rigidity in different individuals. A strong, prominent band is taken as an indication of good powers of secretion. Upon the front part of the bone of the tibia, just below the stifle joint, there may be detected a depression that varies in size in different individuals. A large depression at this place is supposed to indicate great powers of secretion. Its value, however, has never been conclusively proved.

Standards in judging dairy cows.— In order that a cow may be carefully examined in respect to the various characteristics just discussed, various standards, or scales of points, are in use, particularly by students in the agricultural colleges. The application of such a scale of points to any individual is called "scoring," and skill in making judgment is attained only by carefully scoring a considerable number of animals. Such scales, or standards, while they correspond in the main features, differ more or less in minor details, according to the judgment of those who formulate them. Such a standard is given on page 57 as a sample of those in ordinary use.

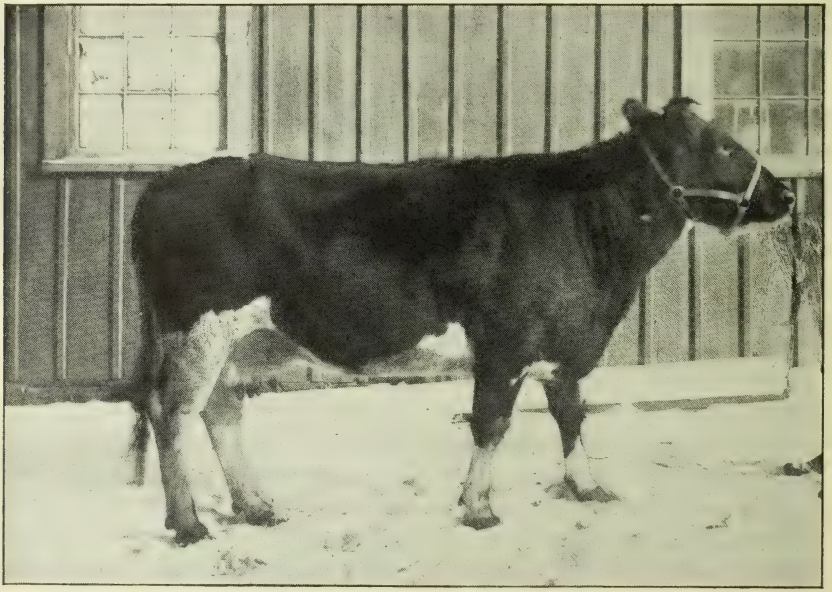

FIG. 34.— *An example of the beefy type of cow, usually unprofitable in the dairy. She uses too much food for laying on flesh, and too little for making milk. Compare with Fig. 33*

GRADING UP THE HERD

The successful and progressive dairyman will not only give his best efforts toward securing a herd that will make a satisfactory production, but will look to the future, and secure still further improvement by breeding from his herd succeeding generations that shall be even larger producers than their ancestors. Such a dairyman may, if he chooses, secure as the foundation herd pure-bred animals that may be depended upon to transmit their qualities to their descendants. But with even the highest-

CORNELL UNIVERSITY
COLLEGE OF AGRICULTURE

SCORE CARD

Dairy cattle

Scale of points	Perfect score	Points deficient: Student's estimate	Points deficient: Corrected
GENERAL APPEARANCE:			
Weight, estimated..........pounds; actual........	......	......	....
Form wedge-shaped as viewed from front, side, and top..........	5	......	....
Form spare, as indicated by prominent joints and clean bone, and lack of muscular development along ribs and loins..........	8	......	....
Quality, hair fine, soft; skin pliable, loose, medium thickness; secretion yellow, abundant..........	8	......	....
Constitution vigorous, as indicated by alert expression, evidently active vital functions, and general healthy appearance..........	6	......	....
HEAD AND NECK:			
Muzzle clean cut; mouth large; nostrils large.....	6	......	....
Eyes large, bright..........			
Face lean, long; quiet expression..........			
Forehead broad, slightly dished..........			
Ears medium size; fine texture..........			
Neck fine, medium length; throat clean; light dewlap			
FORE AND HIND QUARTERS:			
Withers lean, thin; **Shoulders** angular, not fleshy...	3	......	....
Hips far apart; not lower than spine..........	5	......	....
Rump long, wide, comparatively level..........			
Thurls high, wide apart..........			
Thighs thin, long..........	2	......	....
Legs straight, short; shank fine..........	1	......	....
BODY:			
Chest deep; with large girth and broad on floor of chest; well-sprung ribs..........	10	......	....
Abdomen large, deep; indicative of capacity; well supported..........	4	......	....
Back lean, straight; chine open. **Tail** long, slim, with fine switch..........	4	......	....
Loin broad..........	2	......	....
MILK-SECRETING ORGANS:			
Udder large, long, attached high and full behind, extending far in front and full; quarters even.....	20	......	....
Udder capacious, flexible, with loose, pliable skin covered with short, fine hair..........	10	......	....
Teats convenient size, evenly placed..........	2	......	....
Milk veins large, tortuous, long, branching, with large milk wells. **Escutcheon** spreading over thighs, extending high and wide..........	4	......	....
Total..........	100	......	....

Animal..............................**Date**..............................

Student..............................**Total score**..............................

bred animals there will be the necessity for selection if the original standards of production are to be maintained, to say nothing of being increased. On the other hand, the large majority of dairymen seeking to improve their herds must depend more or less upon the individual animals they have already on hand as the basis from which to start the improvement. In either case, careful selection must be practiced, and a knowledge of at least the elementary principles of selection is necessary for progress along this line. It is proposed, then, briefly to indicate the lines along which an attempt to breed up or improve a herd of common native or mixed cattle is most likely to prove successful.

The first step in such improvement is in the selection of a suitable bull. Such a bull, besides being a well-developed individual with strong constitutional and vital powers, must be purely bred in order that he may have sufficient prepotency to transmit his characteristics to his offspring, no matter what may be the qualities of the females with which he is mated. He is likely to be found in a herd all the members of which are uniform in productive capacity and have been bred under the same conditions for a number of generations. A bull useful as a prepotent animal to mate with common or mixed females is quite as likely to be the son of parents of something more than average merit as the offspring of what some are pleased to call " phenomenal " animals.

Select calves that show the good qualities of the bull.— In the improvement of a herd of cows it has been very common to recommend that the practice should be to use a pure-bred bull and to raise the heifer calves from the best cows in the herd. Whether or not this practice is correct will depend, to a great extent, on what is meant by the term " best cows." If it means merely that the heifer calves from the common cows that are the highest producers are to be raised, it cannot be accepted without qualification. The first and great step in improvement under such a course of breeding comes from the prepotent qualities of the bull. Logically, therefore, the best calves to raise are those in which the prepotent qualities of the male are most clearly shown at time of birth, such as in color markings or similar characteristics. These may or may not be the offspring of the highest-producing cows. Our foundation herd of cows is admittedly inferior, even the best of them. If we have exercised proper judgment in selecting the bull we have in him greater chance for improvement than we have in any of the cows, even the best. It would therefore seem to be good logic and safe practice to disregard the qualities of the cow entirely in the first generation and depend on the prepotency of the bull.

A great advantage in the rapid improvement of a herd of cows under this grading-up process is the ability to raise a large number of individuals up to the time they begin to produce, so that a greater number may be available from which to select. In the first generation, therefore, it is a great advantage to be able to raise all of the half-blood heifer calves that are born strong and with good vital powers, irrespective of the qualities of their dams. In many cases, however, the circumstances of the owner do not admit of rearing so large a number, and some selection must be made at the time of birth. If we concede that it is not an entirely safe practice to base this selection upon the producing capacity of the dams, we must look for some other basis of selection.

Breed from cows that show variation, particularly toward improvement.— It is a generally accepted principle of heredity that an animal which shows a tendency toward variation is one that is not likely to be prepotent. We desire to raise calves from cows that are not prepotent in order that the prepotent qualities of the bull may have full scope. Cows, then, that show tendency toward variation, particularly toward improvement, are logically the ones over which the male is most likely to be prepotent and at the same time the calves show the greatest tendency toward improvement. It is comparatively easy to determine in any herd of cows those which show the greatest tendency toward variation, and more particularly those which show the greatest tendency toward improvement when their conditions are made more favorable. We can then determine the cows from which we are likely to get the best half-blood heifer calves

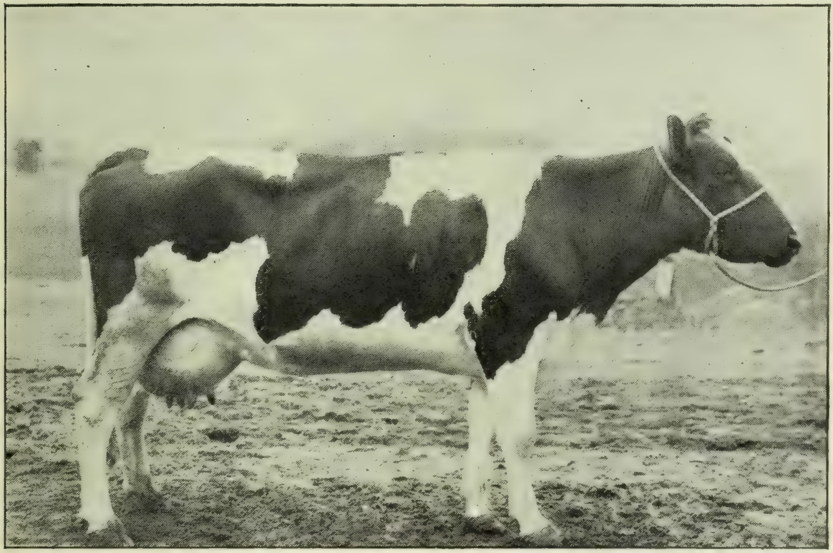

FIG. 35.— *Prominent veins on the udder are thought to be an indication of good milking qualities*

by giving the herd more and better feed and selecting calves from those animals which show the greatest improvement under such a change of treatment.

In actual practice it will be found that the animals that show the greatest increase in production under more liberal feed are not necessarily those that were either the largest or smallest producers under scant rations. This is shown in the following actual occurrence: A record was obtained of the yearly production, in pounds of butter-fat, of a herd of nine cows that had been kept for a considerable period of time under scant rations. The succeeding year these cows were fed liberally — "liberal" in this case meaning practically all the food they would eat regularly — and a record of production was kept as before. The results are seen in the table below, the cows being arranged in the order of their greatest production the first year:

Cow	Pounds of butter-fat produced under scant feeding	Pounds of butter-fat produced under liberal feeding	Percentage of gain or loss
No. 1	177	303	gain 71
No. 2	174	258	gain 48
No. 3	172	314	gain 83
No. 4	169	108	loss 36
No. 5	157	276	gain 76
No. 6	154	274	gain 78
No. 7	132	148	gain 12
No. 8	129	267	gain 107
No. 9	125	232	gain 86

Now suppose these cows the second year had all been bred to a pure-bred bull and they all dropped heifer calves, but that it was possible for the owner to raise only four calves of the nine. If he had based his selection upon those that were the highest producers he would have raised the calves from Nos. 1, 3, 5, and 6. If, however, he had based his selection on those that showed the greatest capacity to improve under more liberal treatment, he would have raised the calves from Nos. 8, 9, 3, and 6. It is for each one to determine for himself which is the more logical practice.

Experience has shown that where the principles stated above have been carefully carried out a very satisfactory improvement has been secured in the first generation. It is not uncommon to find an increase of fully fifty per cent in the average production of half-blood cows over their common mothers. Experience has also shown that in the second generation the three-quarters bloods are not nearly so uniform as the half bloods and frequently show little, if any, increase in average production, though a few individuals will show a marked improvement. The question then comes as to how to secure a greater uniformity and a higher average production in the second generation, or the three-quarters bloods.

Breeding the second generation.— If the selection of the original pure-bred bull has been a wise one and if he was a young animal at the time of his purchase, there will be a considerable number of his half-blood offspring ready to be bred while he is still in the zenith of his powers. Most breeders hesitate to breed such an animal to his own offspring and it is seldom recommended. But if inbreeding is ever likely to be followed with useful results it will be under just such conditions; and in proportion as both the bull and the half-blood heifers show strong individual vital powers, the practice is to be recommended. In a majority of cases, the very best bull to breed to a lot of high-quality, uniform, half-blood heifers is their own sire, if it is desired to secure greater uniformity and greater average production in their offspring. The reason for the lack of uniformity in the three-quarters-bred offspring is the fact that reversions occur to the qualities of their common and mixed grandmothers. It will require, then, even stronger prepotency to overcome this tendency to reversion, and the animal which is most likely to be prepotent over such halfbloods is their own sire.

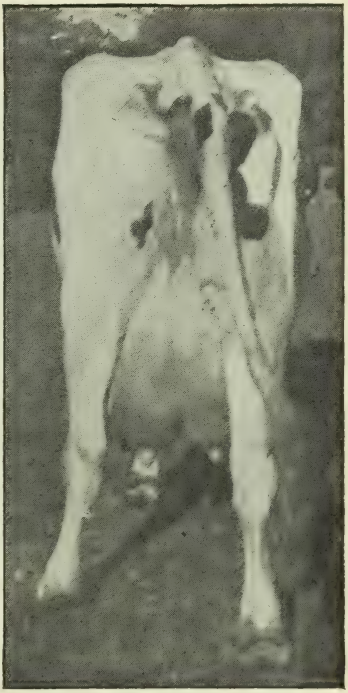

FIG. 36.— *Good hind quarters and a perfect udder. Compare with Figs. 30 and 31*

Continued judicious selection the means of improvement.— It must be remembered that the improved production in the first place was secured by improving the conditions of environment, which, so far as the ordinary dairy herd is concerned, means simply more food; and that it was perpetuated in the case of pure-bred animals by selection. Having obtained improvement now by the use of a pure-bred male on common or mixed females, it is, of course, necessary that it shall be maintained by liberal care and feeding. A pure-bred animal can transmit only its inherited tendencies, and if these inherited tendencies are not backed up by abundant and nutritious food the improvement secured is sure to be lost. Having now secured a marked improvement in two or three generations by the use of a pure-bred male on common or mixed females, with intelligent selection and intelligent inbreeding, the further course of improvement is the maintenance of proper conditions of environment and careful selection. As generations come on, characteristics of the original pure-bred sire will become more and more fixed and uniform, reversions will be less and less frequent, and the herd will be purely bred from the standpoint of the capacity of individual members to reproduce their characteristics, though they never become eligible to registration in a herdbook. This is a course that has been successfully practiced in the improvement of a large number of herds of dairy animals, and is entirely within the reach of any one of ordinary skill and intelligence.

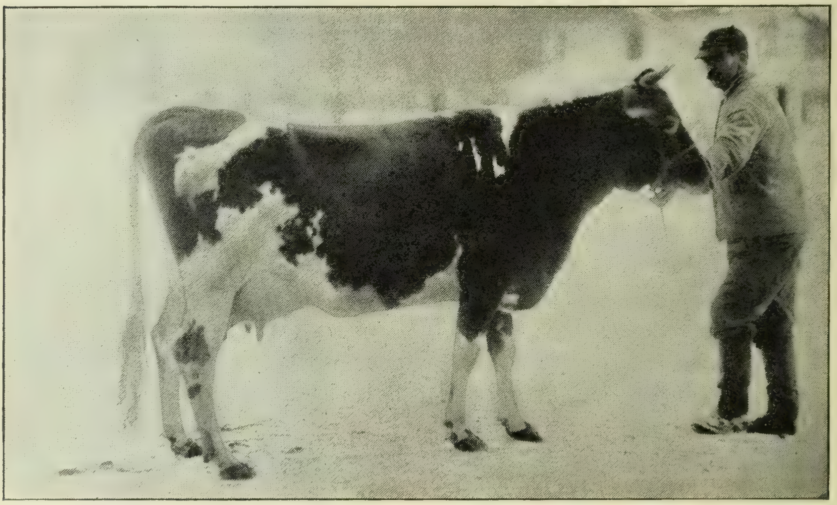

FIG. 37.— *An ideal type in a young dairy cow. Note the fine head, horns, and legs, the well-developed chest, the strong hind quarters, and the large, well-shaped udder*

A specific case in grading up a herd.— As an illustration of this practice there is shown below the improvement that was secured in the case of the descendants bred from a single animal according to these principles.

The table below shows the improvement in the descendants of an inferior cow by pure-bred bulls. Underneath each individual is given the number of years she was in the herd and her average yearly production in pounds of fat. Those indicated by a star are in the herd at the present time, most of them being still immature.

- **Glista** 3 Yrs. Av. 188 lbs.
  - **Glista 2d** 1 Yr. Av 188 lbs.
    - **Gl. Netherland** 5 Yrs. Av. 286 lbs
      - **Gl. DeKol** 6 Yrs. Av. 303 lbs.
        - **Gl. Gamma** 8 Yrs. Av. 336 lbs.
          - **Gl. Mu** 6 Yrs. Av. 285 lbs.
            - ***Gl. Francesca** 3 Yrs. Av. 322 lbs.
        - **Gl. Iota** 7 Yrs. Av. 381 lbs.
          - ***Gl. Ernestine** 3 Yrs. Av. 377 lbs.
        - ***Gl. Omicron** 7 Yrs. Av. 359 lbs.
          - ***Gl. Elgantine** 3 Yrs. Av. 264 lbs.
        - **Gl. Tau** 5 Yrs. Av. 255 lbs.
      - **Gl. Alpha** 10 Yrs. Av. 294 lbs.
        - **Gl. Pi** 2 Yrs. Av. 198 lbs.
        - **Gl. Phi** 1 Yr. Av. 231 lbs.
          - **Gl. Eloise** 2 Yrs. Av. 283 lbs.
          - **Gl. Eleanor** 1 Yr. Av. 286 lbs.
          - **Gl. Omega** 3 Yrs. Av. 309 lbs.
            - ***Gl. Flora** 2 Yrs. Av. 207 lbs.
          - ***Gl. Echo** 3 Yrs. Av. 338 lbs.
          - **Gl. Ebony** 1 Yr. Av. 304 lbs.
        - **Gl. Alpha 2d** 1 Yr. Av. 204 lbs.
      - **Gl. Epsilon** 9 Yrs. Av. 312 lbs.
        - **Gl. Nu** 5 Yrs. Av. 317 lbs.
          - ***Gl. Eva** 4 Yrs. Av. 270 lbs.
        - **Gl. Upsilon** 3 Yrs. Av. 163 lbs.
  - **Glista 3d** 2 Yrs. Av. 252 lbs.
  - **Glista 4th** 8 Yrs. Av. 274 lbs.
    - **Gl. Beta** 10 Yrs. Av. 309 lbs.
      - **Gl. Lambda** 4 Yrs. Av. 292 lbs.
        - **Gl. Chi** 4 Yrs. Av. 281 lbs.
          - ***Gl. Elora** 2 Yrs. Av. 310 lbs.
      - **Gl. Carlotta** 3 Yrs. Av. 299 lbs.
        - **Gl. Dora** 1 Yr. Av. 239 lbs.
      - ***Gl. Cora** 2 Yrs. Av. 413 lbs.
      - ***Gl. Coreva** 2 Yrs. Av. 223 lbs.
    - **Gl. Delta** 9 Yrs. Av. 348 lbs.
    - **Gl. Theta** 7 Yrs. Av. 302 lbs.
      - **Gl. Rho** 4 Yrs. Av. 301 lbs.
        - **Gl. Duchess** 1 Yr. Av. 220 lbs.
      - ***Gl. Psi** 6 Yrs. Av. 345 lbs.
      - ***Gl. Candida** 4 Yrs. Av. 259 lbs.
    - ***Gl. Eta** 10 Yrs. Av. 327 lbs.
      - **Gl. Coriander** 1 Yr. Av. 233 lbs.
        - ***Gl. Draba** 2 Yrs. Av. 298 lbs.
      - **Gl. Corinne** 3 Yrs. Av. 253 lbs.
      - **Gl. Xi** 1 Yr. Av. 180 lbs.
      - **Gl. Sigma** 5 Yrs. Av. 341 lbs.

Average by generations 188 lbs. 238 lbs. 314 lbs. 289 lbs. 268 lbs 303 lbs. 265 lbs.

While the practice outlined above has been particularly applied to the development and improvement of a herd starting with inferior or common cows as a basis, it should be remembered that the same principles apply equally well to any herd. There are very few herds, even the best of purely bred animals, in which the intelligent application of these principles would not result in marked improvement.

ADVANCED READING ON SUBJECTS CONNECTED WITH DAIRY FARMING

General

Eckles, C. H. Dairy cattle and milk production. The Macmillan Company, New York. $1.60.
Wing, H. H. Milk and its products. The Macmillan Company, New York. $1.50.
Harper, M. W. Manual of farm animals. The Macmillan Company, New York. $2.
Lane, C. B. Business of dairying. Orange Judd Company, New York. $1.25.
Plumb, C. S. Types and breeds of farm animals. Ginn & Company, Boston, Mass. $2.
Winslow, K. Production and handling of clean milk. W. R. Jenkins Company, New York. $3.25.

Structures

King, F. H. Physics of agriculture. The Author, Madison, Wis. $1.40.
King, F. H. Ventilation. The Author, Madison, Wis. 75 cents.
Farm buildings. Sanders Publishing Company, Chicago, Ill. $2.
Shawver, J. L. Plank frame barn construction. David Williams, 232 William Street, New York. 50 cents.
King, M. L. Silos — Construction and service. Webb Publishing Company, St. Paul, Minn. $1.50.

Feeding

Henry, W. A. Feeds and feeding. The Author, Madison, Wis. $2.25.
Jordan, W. H. Feeding of animals. The Macmillan Company, New York. $1.50.
Smith, H. R. Profitable stock-feeding. The Author, St. Anthony Park, Minn. $1.20.

Breeding

Davenport, E. Domesticated animals and plants. Ginn & Company, Boston, Mass. $1.20.
Davenport, E. Principles of breeding. Ginn & Company, Boston, Mass. $2.50.
Marshall, F. R. Breeding farm animals. J. H. Sanders Publishing Company, Chicago, Ill. $1.50.

Diseases

Law, J. The farmers' veterinary adviser. W. R. Jenkins Company, New York. $3.
Mayo, N. S. Diseases of animals. The Macmillan Company, New York. $1.50.
* Diseases of cattle. U. S. Agr. Dept., Bureau of Animal Husbandry, Washington, D. C.
* Diseases of the horse. (Same as above.)

Judging

Craig, J. A. Judging live stock. F. R. Marshall, Berkeley, Cal. $1.50.

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*Free from your Senator or Representative in Congress; 85 cents each from the Superintendent of Documents, Washington, D. C.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

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W. A. Stocking, Jr., *Acting Director* A. R. Mann, *General Editor*

COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 54 DECEMBER 15, 1913 **DAIRYING SERIES No. 3**

THE DAIRY HERD

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if information is requested.

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The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested in the course.

1. What breed or grade of dairy cows do you keep? What are your preferences as to breed, and why?

2. What kind of a sire do you keep at the head of your herd? To what extent is he prepotent?

3. Do you keep a record of the production of each cow?

4. In your judgment, how reliable are the points of conformation mentioned in this lesson? Give your opinion of each.

5. What experience have you had in grading up a herd? We should be glad to have specific records of production.

Name..............................

Address..............................

Date..............................

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NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

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PRACTICAL HORSE-BREEDING

M. W. HARPER

For about one half of the year the farmer uses his horses constantly. During the growing season the horses are sometimes overworked, whereas for the remainder of the year the cost of maintaining the animals often exceeds the value of their services. Such is likely to be the case when horses are kept merely for the work that they can do. There are many successful farmers, however, who maintain sufficient horses to do the work of the busy season without overwork. Mares are kept by such farmers, and in order to make them earn their keep during the idle season they are bred, thus producing a colt in addition to the work that they accomplish. Thus, instead of purchasing a team every few years, these farmers derive an income from the sale of surplus stock. The money obtained from the sale of horses that have been raised will fully compensate for the maintenance of all horse stock during the idle season. There are many successful farmers,

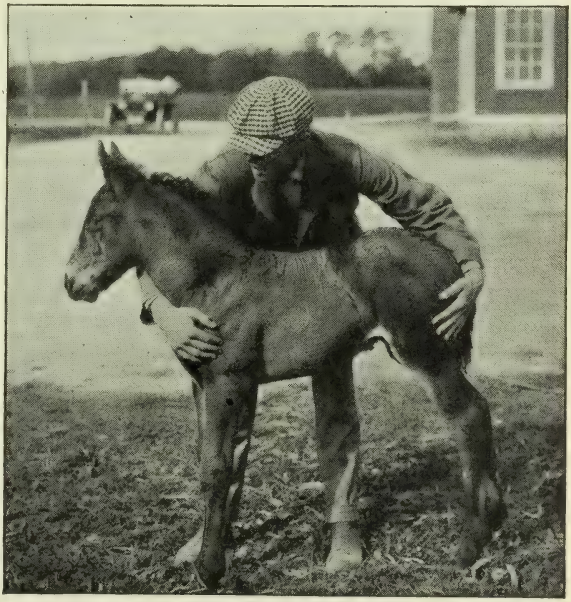

FIG. 38.— *Catching and holding a young foal*

however, whose practice is to maintain an adequate number of mares for the work of the growing season, and to breed them in order that they may earn their support during the idle season.

SELECTION OF BREEDING ANIMALS

In the selection of breeding stock, the principle of heredity that "like produces like" must not be forgotten. This principle applies to the brood mare as well as to the stallion. Inferior qualities possessed by the mare are as likely to appear in the colt as are inferior qualities possessed by the stallion. The influence of the mare in the transmission of qualities to the foal is often much underestimated, and frequently is ignored entirely by horse-breeders. The general appearance and the pedigree of the stallion are given much prominence, while in the brood mare they are sometimes entirely lost sight of. The farmer who keeps worthless mares for breeding merely because he cannot sell them will not be able to compete with his neighbor who keeps only the best brood mares, even though they both patronize the same stallion. Occasionally an inferior mare may produce a fine colt, but no man can afford to breed horses for the exception.

In breeding horses it is a serious, but common, error to suppose that the bad points in one animal can be fully offset or overcome by the good points in the mate. The popular statement that the stallion controls outward characters and the mare internal characters of the offspring has led many breeders to think that the offspring will resemble the paternal parent irrespective of the mother. Such is not the case. Errors in conformation are not to be offset by choosing a mate that is abnormally developed in the corresponding character. The foundation principle of successful horse-breeding is to mate two animals both of which are as nearly perfect as possible.

The stallion

In selecting the stallion, there are three important factors to be considered: first, the individual merit, or the perfection of the animal as a representative of its type or breed; secondly, the pedigree, or the purity of the ancestry and the probable capacity of the individual to reproduce itself or to show improvement; and thirdly, the suitability of the two individuals to be mated.

In breeding horses the perfection of the animals selected should be carefully considered. Occasionally stallions are selected on the basis of their pedigree. Such practice may prove disappointing, for many inferior individuals are recorded merely because such animals command a good price on the market. In choosing breeding horses each animal should be closely inspected, and only superior individuals should be placed in the stud.

Purity of ancestry is an important factor in choosing the stallion, for the capacity of a horse to produce superior offspring will depend largely on his ancestors. Often it is a question which factor should receive a larger share of attention, the individual merit or the pedigree. Formerly great length of pedigree was associated with breeding quality, but the present evidence goes to show that it is the immediate ancestors that are of most importance.

Lastly, in order to be suitable for mating, two animals should be as nearly alike in general characters as it is possible to select; otherwise the outcome of a union cannot be foretold. Since no two horses are exactly alike, the outcome is likely to be an average between the characters of the parents and what it is desired to obtain in the offspring. When the offspring shows good qualities the mating is considered a fortunate nick; when there is no resemblance to either parent, but to some near ancestor, the recurrence is called atavism; and if to some of the far-removed ancestors, it is called reversion. These latter two terms are often used interchangeably. The success of a horse-breeder often depends on his ability to mate animals properly. Some persons become very skilled in such matters.

The mare

No matter what type or breed is selected, the brood mare should be of good size for the breed to which she belongs. Her conformation should be rather open. The head should be fine and feminine in appearance and the neck should be thin. The shoulders should slope well into the back, and the withers should be high rather than low. The back should be rather short, with a somewhat long underline. The ribs should be well sprung and rather open. The hips and the short ribs should not approach each other too closely. The hind quarters should be broad and deep. The pelvic region should be broad so as to insure ease of foaling. The legs and feet of the brood mare should be especially noted. The bones of the limbs should be clean and free from coarseness, so that the legs appear wide and flat. The tendons should be prominent and free from meatiness, and the hair should be fine, silky, and glossy.

It is of great importance that the brood mare be free from all forms of unsoundness or disease that is hereditary or communicable to the offspring. Many breeders have fallen into the error of considering any broken-down, halt, maimed, blind, or otherwise unsound mare fit for breeding purposes when no longer able to work. Blemishes that result from accident are not hereditary nor transmissible and do not render the mare unfit for breeding. The greatest possible care must be exercised, however, in deciding whether the blemish is the result of accident or is an inherent deficiency.

Furthermore, it is desirable that the brood mare shall have a good disposition. Infirmities in temper seem to be readily transmitted to the offspring. Moreover, pregnant mares are often quarrelsome, and distressing accidents may occur when the mare has a naturally vicious disposition.

While absolutely perfect mares can rarely, if ever, be found, and few farm breeders can afford to reject a mare for small and unimportant defects, yet it would be a great advantage to each horse-breeder and a boon to the horse-breeding industry if all actually unsound and notably unsuitable mares were rigorously rejected when breeding stock is being selected.

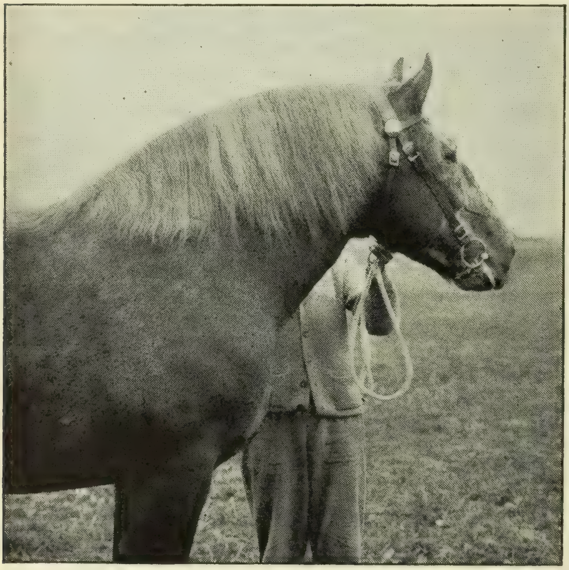

Fig. 39.—*Head of Percheron, showing character*

PRODUCTIVE PERIOD IN BROOD MARES

The most fertile period in the mare's life is usually at four to twelve years of age. In exceptional cases this period may begin at an earlier age and last longer. Occasionally a filly will breed freely at two years of age, thus foaling her first colt at three; and not unfrequently mares breed when past twenty years of age.

Breeding two-years-old fillies

The advisability of breeding a two-years-old filly depends on at least three important factors: *First*, the breed: Horses of draft breeding mature much earlier than do lighter and more active breeds, so that a draft filly of two years is often as forward as a trotting or running filly at three years of age. *Secondly*, the individual animals: Individuals differ considerably in attaining maturity. Usually a smoothly turned, neat, and well-finished filly makes its growth earlier than does a rougher, more vigorous individual. Feeding and care also have much to do with the early maturity of the filly; one that is kept growing continuously will mature earlier than one that is imperfectly cared for and that receives a setback each winter. *Thirdly*, the object sought: If the breeder is endeavoring to improve the strain, he should never attempt to breed a two-years-old filly. On the other hand, when draft horses are wanted merely for marketing there is no reason why fillies cannot be bred at two years of age, provided they are mature and have been well grown, and their owner is willing to feed and care for them properly during their pregnancy. Nor is there any reason why they should not be bred each year thereafter. They should not be put to work, however, until past three years of age.

Breeding aged mares

At about twelve years the reproductive powers of some draft mares begin to wane, although many mares are reliable breeders to about fifteen years, especially if they have been bred continuously from their maturity. Above this age it is rarely profitable to keep them for breeding. Perhaps it is best to dispose of draft brood mares at ten or twelve years of age unless they are exceptionally good breeders, in which case they should be kept as long as they will breed.

SEASON OF THE YEAR IN WHICH TO BREED

Mares breed naturally in early spring. At this season their breeding condition is more readily observed and they more frequently conceive than at any other time during the year. The spring of the year is the natural breeding season; but, because of the heavy spring work, it is necessary on many farms that mares be bred so as to have the colts come in the fall.

Spring foals

When convenient, the spring is the desirable time to breed the mare. This season has many advantages. Not only is the mare's breeding condition more readily noted, but her chances of conceiving are much greater and the foal comes at a time when it is much more easily managed. The housing is simplified; if the weather is warm, the mare and the foal may be turned into a small paddock or a pasture. If the mare is worked during the day she should be fed her evening meal before going to pasture, since she needs nutritious food and grass is too succulent to meet the demands made on her system. The grass that she eats will serve to keep her in good physical condition and to stimulate the flow of milk. This practice gives the foal the range of the field, so that it may take the much-needed exercise without which no foal can develop endurance. Soon the foal will learn to nibble the grass, and this will prove beneficial, for grass is a good supplement to milk for a suckling colt. If the foal is given a little grain at the same time that the dam receives her ration, it will thrive and develop more quickly than will a fall colt.

Aside from the inconvenience of the foal while the dam is being worked, the chief objection to a spring colt is that it must be weaned in the fall just about the time of going on dry feed. At this time the colt must receive extra feed and attention, or it will lose flesh and its future development and usefulness may be retarded.

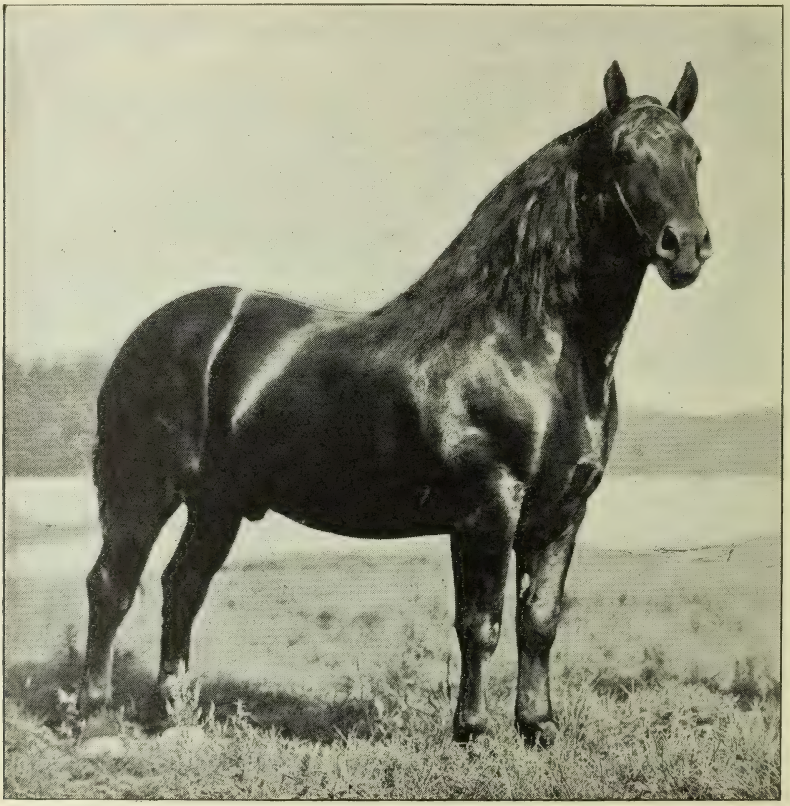

FIG. 40.— *Percheron stallion, showing character*

Fall foals

On grain farms the heavy work begins in March and continues until August; in dairy districts, where much hay is to be harvested and many silos are to be filled, it may last until October. When fall foals are to be raised the mares should be bred so as to foal as soon as convenient after the season's work, provided the foals do not come when flies are especially annoying. The time of breeding and other details will be modified by circumstances.

While the mare is not so likely to breed in the fall as in the spring — due, in part at least, to her thin condition after the summer's work — yet by increasing the food, especially the grain ration, by blanketing, and by moderate and regular exercise, the desired results can often be attained. The bowels should be kept free from constipation by feeding moderate amounts of succulent food. Conditions should be made as springlike as possible.

If the foal comes in the winter it will need extra warm quarters and extra attention. The dam will need milk-producing foods, such as clover or alfalfa hay, oats, bran, and a few carrots if they are available. She should be exercised regularly. If the breeder feeds succulent food, such as carrots, and provides sufficient exercise for mare and foal, it is possible to raise a winter colt that will be a strong rival to the average spring colt.

BREEDING THE MARE

The habits or the work of a mare should not be changed at breeding time, but she should be used as she was before the service. Often work mares are bred and then turned into pasture. This is a poor practice, since the sudden change from dry grain and hay to pasture, and from work to idleness, will so upset the system of a mare as to render conception difficult. In like manner, a change from the pasture to a diet of hay and grain will have a similar result. The quieter a mare is kept at time of service, the better it will be for her. If possible, long drives to and from the stallion should be avoided. When it is desired to breed to a stallion located at some distance, arrangements should be made to leave the mare near him for a time.

Breeding condition

While mares differ widely in the recurrence of their breeding condition, this difference is not so great as to render a general rule inapplicable. A mare bred on the ninth day after foaling will usually conceive; if she is healthy and has received no injuries in giving birth, it is good practice to breed her at this time. When she should be returned in order that it may be determined whether or not she has conceived is a much-discussed question, owing to the fact that mares differ in this respect. The horse-breeder should make a study of the individuality of his mares so as to return them at the proper time. In common practice the mare is returned on the twenty-first day after the first service, and every seven days thereafter for at least one month, particularly when the mare is valuable and the owner wishes to make sure she is in foal.

Some mares are shy breeders and are never observed to be in breeding condition. If it is desired to breed such a mare, occasionally it can be accomplished by hoppling her securely and then breeding her. In approximately three weeks from this service she may be observed to be in breeding condition, when she should be bred again. On the other hand, there are many mares that will freely be served even when in foal, in some cases up to the time of foaling.

Sterility in mares

Often it happens that mares are served normally and yet fail to conceive. Some of the causes of this difficulty are readily understood and easily prevented, while others are not so well understood and perhaps are beyond the control of breeders. Mares that are not served until late in life are often difficult to impregnate for the first time. This is often noticed in mares that have spent a good part of a lifetime at hard work. In such cases it is due perhaps to the long inactivity of the generative organs. An excess of rich and stimulating foods is a common cause of nonbreeding. This is undoubtedly one of the most frequent causes of barrenness, and

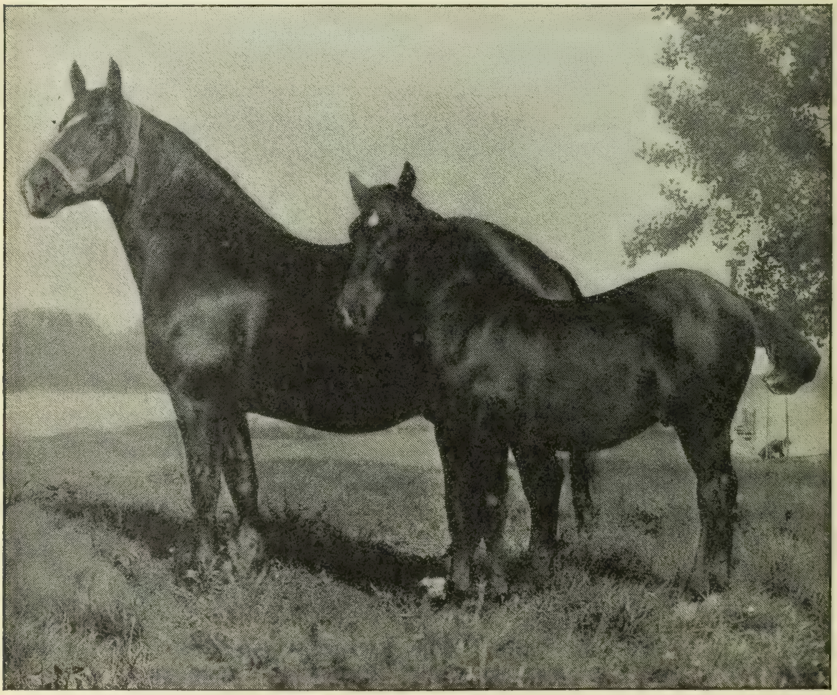

FIG. 41.— *Percheron mare and yearling colt*

the dangers attending parturition are more than trebled in the case of fat animals. Milk fever never occurs in mares that are kept actually at work and are in only moderate flesh at the time of foaling. On the other hand, barrenness may be due to poor feeding and hard work, the system being weakened by the lack of sufficient nutrition. Undue sexual excitement at the most active stage of heat is often responsible for the nonconception of the mare. In addition, there are many causes of barrenness in mares over which the breeder has little or no control, such as derangement of the female organs, diseased ovaries, tumors, and the like.

Abortion in mares

Abortion is the expulsion of the fetus at any time from the date of impregnation until the foal can survive out of the womb. It is produced by any cause operating to disconnect the union of the fetal membrane with the uterus. The mare may abort by reason of almost any cause that disturbs her system generally, such as the influence of too stimulating a diet or the reverse, wet seasons, a previous miscarriage, and all circumstances opposed to efficient nutrition and respiration. The more direct mechanical causes are falls, blows, violent exertion, severe illness, large draughts of cold water, or the eating of iced grass, the ergot of rye, the smut of corn or other grain, and the drinking of filthy stagnant water; also, traveling on heavy, muddy roads or on soft plowed ground, or jumping over fences, ditches, and the like.

The prevention of abortion is the avoidance of all causes that may have a tendency to produce it. When abortion has once occurred, the greatest care in subsequent management is necessary. The breeder must avoid all practices that may cause constipation, diarrhea, or indigestion. When all measures fail and miscarriage results, all that can be done is to assist in the removal of the fetus and its membranes as in ordinary parturitions. The mare should have special care at this time. She should have a roomy, well-lighted stall, plenty of air, and easily digested food. The mare should not be served again for a month or longer, and in no case until after all discharges from the vulva have ceased.

The pregnant mare

The pregnant mare should receive such a ration as will supply her demands for energy and, in addition, allow ample nourishment for the development of the foal, both before and for a short time after birth. Her work should be so regulated as to protect her from becoming tired, overheated, or injured in any way. There is no secret in raising colts further than feeding to the mother a moderate amount of nutritious food and providing sufficient exercise to keep mare and foal in good physical condition.

Working the pregnant mare.—Moderate work is not only harmless, but positively advantageous, to mares in foal, provided proper care is taken not to overload them. It is much better to work them than to keep them tied in the stable in want of exercise, or to permit them to run at large in the fields with other horses where they are exposed to accident resulting from racing, playing, or fighting with each other. Pregnant mares are usually quarrelsome, and abortions frequently occur from injuries received at the heels of other horses. If proper care be taken, the mare can safely be used at the ordinary work of the farm up to the very day of foaling; but as the time approaches it is important that the work be not heavy or the pace rapid. She must not be fretted by the other horse or by rough, inexperienced hands.

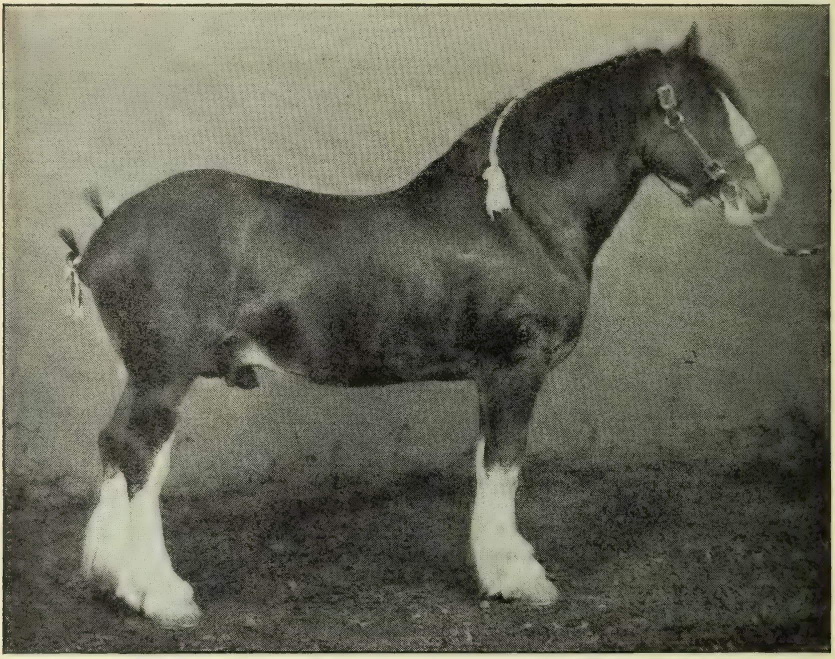

FIG. 42.— *Clydesdale stallion, showing character*

Feeding the pregnant mare.— The food of the pregnant mare is most important. Many persons fail of success in horse-breeding by depending on blood alone to improve the stock. They forget that all of our improved breeds of horses are the product of adequate nutrition as well as intelligent breeding, suitable environment, sufficient shelter, and kindly care.

The quality of the ration is of as much importance as the quantity. Fat production is to be avoided, and the formation of blood, muscle, and bone should be induced. Foods rich in protein and ash, such as oats, bran, clover, and alfalfa, are preferable to starchy foods, such as corn. A very good ration for the pregnant mare is as follows: four parts ground oats, four parts wheat bran or its equivalent, and one part linseed meal, with bright clover or alfalfa hay for roughage.

Pregnant animals have a tendency to fatten as pregnancy advances. This tendency must be guarded against in the mare, since superfluous flesh may interfere with the development of the foal, cause abortion, or induce difficulties at parturition, such as milk fever and garget. The ration of the mare should be reduced just before foaling and for a short time thereafter, and should be made laxative by the addition of a succulent food, such as carrots, or an occasional bran mash. This practice should be continued until both mare and foal have recovered from the ordeal incident to birth.

Parturition

The average period of gestation in the mare is popularly placed at eleven months—more accurately, perhaps, three hundred and forty days; but the time may vary greatly. Because of the uncertainty of the period, the mare should be closely watched from the tenth month until parturition. There are certain indications of the near approach of parturition that rarely fail. Often the udder becomes greatly distended for some time before foaling, but the teats seldom become full and plump to the end earlier than two or three days before the foal is born. About a week or ten days before foaling, there is a marked shrinking, or falling away, of the muscular parts at the top of the buttocks, in back of the hips. Another indication is the appearance of the wax at the ends of the teats. This generally appears not earlier than three days before the foal comes. Occasionally, however, the foal may be born without any of these signs.

From about the three hundred and thirtieth day, or when the characteristic symptoms begin to appear, the work should be much lightened and the grain ration should be reduced, although for the best results the mare should be kept at light work up to the day of foaling. Bran mash will prove very beneficial now, since it will keep the bowels in good condition and will allay any tendency to feverishness. The mare should have a roomy, well-lighted, and well-ventilated box stall, thoroughly clean and freshly bedded.

During the night it may be necessary that a caretaker be near at hand in order to render assistance if need arises, but the mare must not know of his presence. Most mares will not give birth to their young in the presence of persons if they can help it.

If birth is easy and normal, both mare and foal should be let alone. They will come through the ordeal safely. If, after a reasonable time, the mare shows that she cannot deliver the foal, or if examination discloses that there is an abnormal presentation (normally the forefeet appear first, then the nose), a veterinarian should be summoned at once. The breeder should not wait too long, since the strength of the mare rapidly fails and delay is dangerous.

The mare after foaling

If all is normal after foaling, the mare will usually get up and care for her foal. After she is on her feet there should be offered her a drink of gruel, made from a pound of fine oatmeal in half a bucket of water from which the chill has been taken. While the mare should be lightly worked up to the day of foaling, it is essential that she have a few days rest after foaling; how long a rest she should have will depend on the condition of the mare and the foal, and on the financial circumstances of the breeder. Strong mares that have recovered satisfactorily will be able to do light work in three or four days if need be, whereas others will need a rest of at least two weeks in order to recover from the shock. As soon as the mare is able, however, she should be given light exercise, since exercise is essential to the well-being of both mare and foal.

The foods given the brood mare when nursing her foal should be such as have a tendency to produce milk. Timothy hay and corn alone are not good milk-producing foods. The ration suggested above for the pregnant mare is better, and it could be much improved if a small quantity of succulent food, such as carrots, were fed with it. Many mares at best are poor milk-producers and they must be encouraged. Plenty of good, fresh grass is one of the best aids to healthy and abundant nutrition for both mare and foal.

The breeder should keep close watch of the mare's udder and the condition of the colt's bowels. If the bowels of the colt are loose and he is scouring, he may be having too much milk. In that case the mare should be partly milked by hand. If the colt is not taking all the milk, it is necessary for the breeder to milk the mare. Otherwise the udder will be greatly distended, will become sore, and may possibly cake, which will result in trouble for both mare and foal.

THE YOUNG FOAL

The young foal that makes its appearance normally and is bright and active needs only to be let alone. If proper attention is given to the food and the exercise of the mare, the foal should thrive without special care. Not all foals are equally fortunate, however. Occasionally one loses its life through want of attention at the time of birth. Occasionally one is subject to digestive disorders that must be attended to and remedied at once before they prove fatal. Sometimes one is troubled with that infectious navel disease which may be due to unsanitary conditions at the time of foaling.

The foal's first meal

It is essential that the new-born foal receive the first milk from the dam. This foremilk appears thick and yellow, and is a natural purgative for the removal of material that has accumulated in the foal's digestive tract during the last few days of its development. The prompt removal of such material is essential to the life of the colt. Sometimes the foremilk, or colostrum as it is called, is drawn off as being unfit for the colt, but this practice is a common cause of death to the foal within two or three days after birth.

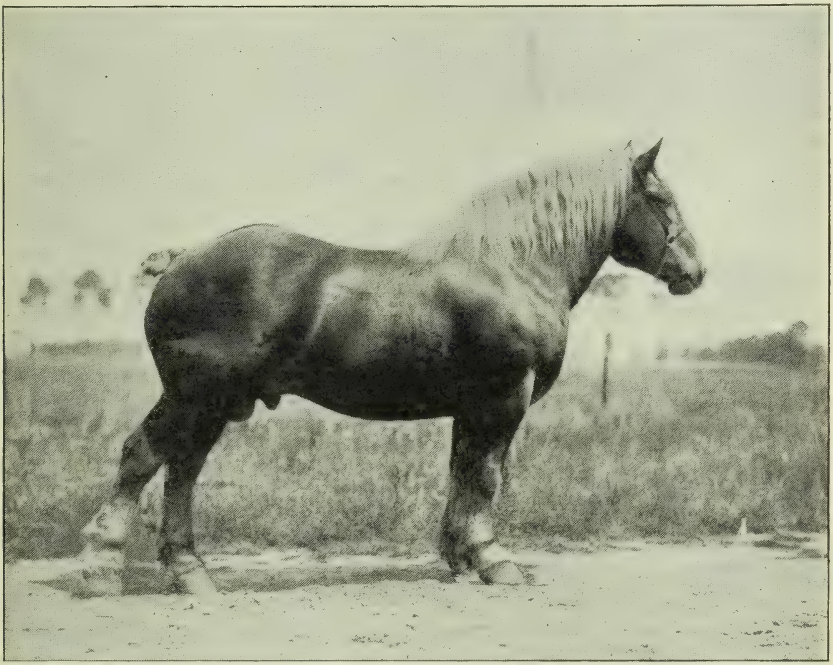

FIG. 43.— *Suffolk stallion, showing character*

If the foal receives its first meal of colostrum within an hour after birth, it will ordinarily do well. Usually the bowels move within four to six hours. If the bowels do not move within twenty-four hours, and if the colt presents a droopy, listless appearance, it should be given two ounces of castor oil. Usually in four to six hours relief will have been gained and the appearance of the youngster will have changed greatly for the better.

Most breeders advise leaving the colt in the stable while the mare is at work; others allow the colt to follow the mare into the field. Much depends on the nature of the work that the mare is doing. In some kinds of work the foals may follow without risk to mare or colt, while in other kinds, such as mowing hay or reaping grain, they cannot be allowed to follow. If the foal is kept in the barn, the mare may worry and fret and perhaps heat herself badly at first, but in time she will become accustomed to the separation.

A foal should never be allowed to draw milk when the mare is warm. On being brought in from work, the mare should be given a drink, but she should not be allowed to drink too much if she is warm or if the water is very cold. After she has cooled off and some of her milk has been drawn by hand, she may be turned into the stall with the colt with perfect safety to both.

Feeding the young foal by hand

It often happens that the milk of the mare is insufficient to promote healthy, vigorous growth in the foal, and occasionally it becomes necessary to raise a foal independently of the dam. In such cases the best addition to, or the best substitute for, the milk of the mare is that of a cow. The milk of the mare contains more sugar and less fat than does the milk of the cow. The breeder should therefore obtain milk from as fresh a cow as possible; the poorer in fat the milk is, the better it will be for the foal, since mare's milk will average only about one and one half per cent fat while the milk of most cows contains more than three per cent. Jersey milk should not be used for colts, since it is too rich in fat.

Patient effort will soon teach the colt to drink milk readily, but care must be taken that it does not receive too much at first. A half pint is sufficient for a foal two or three days old, but the ration should be repeated often. If from the beginning it is necessary to feed the foal cow's milk, the milk should be modified. Four tablespoonfuls of limewater should be put into a pint jar, which should then be filled with fresh cow's milk. A dessert-spoonful of white granulated sugar should be added for sweetening. The mixture must be warmed to blood heat and the foal should receive half a teacupful every hour at first. If the colt scours, a dose of two ounces of castor oil should be administered and the feed should be discontinued for two or three hours. As the colt grows older, the amount of food should be increased, and the frequency of feeding should be decreased first to twelve, then to nine, six, and lastly four, times each day. The purpose is to give the foal all that it will drink, and to feed so often that it will not require a large quantity at a time.

Common disorders of the young foal

It sometimes happens that the newborn foal cannot breathe. In such a case, measures must be taken quickly to establish the function of respiration by blowing violently up the nostrils and into the mouth, and by briskly rubbing the body. If breathing is slow, a few tablespoonfuls of brandy and water, given after the first few respirations, will be of material service in invigorating the low vital processes.

As soon as the mare has recovered from the shock of giving birth, she should be allowed to tend the foal, for it will be physically benefited thereby. If she refuses to dry and caress her foal, a little flour sprinkled over the back of the latter will often attract her to it. Should she still refuse, the foal must be dried with a soft flannel, aided to find the teat, and assisted to obtain its first meal.

Constipation.— Notwithstanding the purgative effects of the colostrum, or first milk, the young foal frequently suffers from constipation of the bowels, especially if the mare has not been in good health during the latter periods of pregnancy. Sometimes the first milk of the dam will not agree with the young foal, or through weakness the foal may not have obtained a good draft. Whatever the cause, if the digestive tract has not been cleaned of its contents within twenty-four hours and if the foal presents a listless appearance, with eyes dull and ears drooping, it is necessary to stimulate the action of the bowels. Ordinarily the bowels will be stimulated to action by the administering of two ounces of olive oil or castor oil, and by an injection of warm water into the bowels. The water should be at blood heat and should have added to it a teaspoonful of glycerin and enough warm water to make four or five ounces — but no more, for only a small quantity is needed. This mixture should be injected gently into the rectum with an ordinary two-ounce, hard-rubber syringe. Care must be taken not to rupture the tender membrane. This injection will lubricate the passage and induce the foal to endeavor to pass the fecal matter, which is a yellowish, rather hard, waxy substance. If given as directed, the injection can do no harm and may be repeated every hour. In five hours relief will usually have been gained and the appearance of the youngster will have changed greatly for the better.

Diarrhea, or scours.— This disease is rather prevalent among suckling animals and is often fatal. Although less subject to the disease than calves are, foals often die from it within a short period of time after birth. The causes are not certainly known. Ordinarily it is attributed to changes of an unknown character that take place in the composition of the milk. Two facts, however, have been determined: first, that the causes of scours are many and varied; secondly, that their potency is increased by unclean surroundings, especially by unwholesome stables. Well-known causes are the nonremoval of fecal matter from the digestive tract of the foal, and nervous disorders that materially affect the health of the mare, such as a fretful condition when kept away from the colt soon after parturition. If the mare becomes feverish, the quality of her milk is altered, and the foal coming to her hungry gorges itself with the changed milk, which induces indigestion and diarrhea.

Rich foods given to the mare may stimulate the flow of milk to such an extent that, if the foal is permitted to take all, digestive disorders and diarrhea will follow. In early spring when the mare is pasturing on a rank growth of succulent grass, a similar condition is likely to result. For the same reason, a cold, damp bed or exposure to cold rainstorms is to be avoided. While a passing shower, even if cold, may do no harm, prolonged exposure to rain and to a low temperature are likely to prove fatal to a newborn foal. Confinement in close buildings is objectionable to mare and foal alike; in both it induces a weakened condition and leaves the system an easy prey to disease.

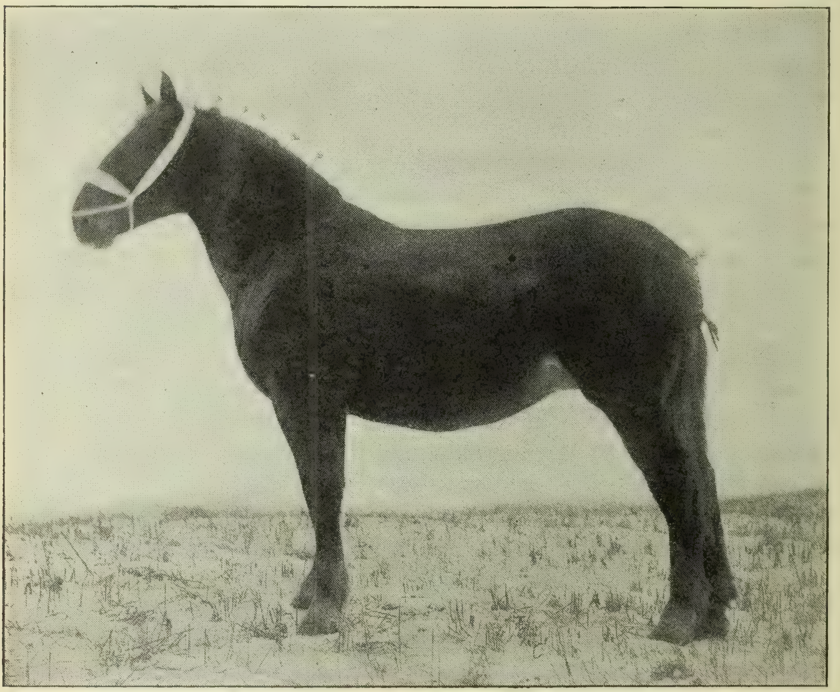

FIG. 44.— *Suffolk filly*

The best practice is to avoid conditions that are likely to cause such disorders. If the dam is properly fed and exercised, there is little danger.

On the other hand, should digestive disorders appear, the foal must receive immediate attention and the cause must be removed; even then relief may come too late. When the attack is due to an oversupply of rich milk, the dam should be milked in part by hand.

In administering treatment the nature of the difficulty should not be ignored. It is caused by an irritant in the stomach or the bowels that must be removed before a cure can be effected; hence the breeder should be cautioned against giving an astringent with a view to cutting off the discharge. In all such cases the best practice is to expel the disturbance with a laxative, such as two ounces of castor oil, and later, after the irritant has been expelled, to check the discharge by a weak solution of gum arabic or slippery elm or by well-boiled linseed tea or starch. Even this treatment is beset by many a difficulty.

Fig. 45.— *Mares and foals at pasture*

Navel infection.— Another disease common to young foals is the so-called navel infection, or joint disease. It should be understood that this disease is due to filth germs that gain access to the body of the foal by way of the open umbilical vein of the navel at birth. When these germs enter the body they set up irritation and inflammation; pus forms and is absorbed into the circulation from the navel abscess, and other abscesses are formed in all parts of the body, especially in the joints of the limbs. The foal is seen to have a swollen joint, and the breeder is likely to think that the mare caused the injury; other joints will soon be affected, however, and the condition may affect the throat and the poll as well. It is comparatively rare that an infected colt can be saved after the disease has reached the pus-forming stage.

It has been proved that simple hygienic measures will prevent the disease. The stall in which the mare foals should have every bit of old bedding, litter, and dirt removed, and the young foal should be born only on clean, fresh bedding. Perhaps it would be a safeguard to wash the stump of the umbilical cord — which should never be cut, but should be allowed to break of its own accord — with a saturated solution of boracic acid, and then to dust it with boracic-acid powder.

Feeding the foal

As soon as the foal is old enough it should be encouraged to nibble at grain, preferably oatmeal or wheat bran. It will begin to munch grain and hay at three or four weeks of age. If it is necessary that the foal have milk after it is two months old, skimmed milk should be substituted for the fresh milk of a cow. A colt should never be fed sour milk or milk from unclean vessels. Should there be any trouble from constipation, it will be well to add about one half pint of oil meal to the ration each day. Oil meal can be fed with profit to growing colts, since it furnishes a large proportion of muscle-forming and bone-forming food. The effect of a ration consisting of sweet skimmed milk, ground oats, and oil meal on the growth and development of a foal is remarkable, and in all cases when the foal is likely to enter winter in low flesh such a ration cannot be too highly recommended.

Weaning the foal

Weaning depends rather on the preparation of the foal for leaving the dam than on the actual removal. The simplicity of the weaning process depends on the thoroughness of the preparation. If the foal has become accustomed to eating grain, if it has been permitted to take increasingly more as it grew, the process of weaning should not be difficult; for as the ration increases in amount of grain, it will decrease in the amount of milk consumed. When the time arrives for complete separation there will be little, if any, inconvenience or disturbance to either foal or dam. On the other hand, if the foal must learn to eat after having been deprived of its accustomed source of supply, it will require time to become adjusted to the new condition, and the mare will demand special care because of the removal of the colt before her milk supply has been gradually diminished.

Foals are usually weaned at four to six months of age. If the mare was bred soon after foaling and conceived, it is best to wean the foal early, so that the mare will have time to recuperate and nourish the fetus. If for any reason mare and foal are not doing well, it is perhaps best to wean comparatively early. If, on the other hand, the mare has a full flow of milk and her services are not needed, there is no reason for weaning a foal under six months of age. When dam and foal are separated, it is better for both that the separation be complete. If, after they have become reconciled to the separation, they are permitted to see, hear, or smell each other, all the contentment that has been gained may be lost.

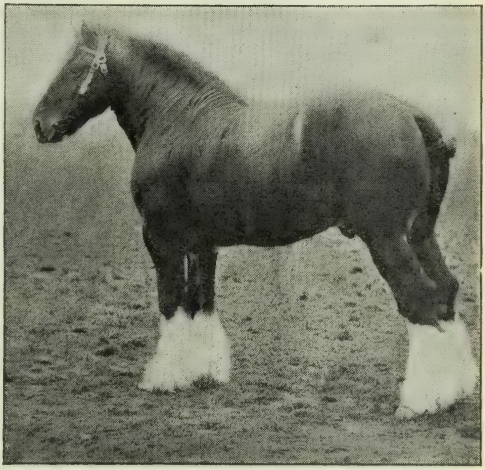
FIG. 46.— *Shire stallion, showing character*

At the time of weaning, the food and the udder of the mare require special attention. The mare should be worked if she had previously been at work, but her grain ration should be reduced until she is dry. When the udder becomes so full as to cause her uneasiness, part of the milk should be drawn, but she should not be milked dry; if all the milk is withdrawn each time it will require a longer time for her to become dry. Care should also be taken to see that the new quarters where the weanling is confined are so constructed and arranged that it cannot injure itself while fretting over the separation from its mother.

Skimmed milk may still be given to the colt, especially if the colt is not in good condition to enter the winter. Clean, sound oats that have been ground constitute the best of all grains for the weanling. As cold weather approaches, the ration should consist of oats with one fourth part corn meal by weight, since the latter aids in producing fat and keeping up the animal heat. If a pint of oil meal is added to this mixture, the weanling will make good gains in spite of the cold weather and the separation from its mother. The breeder does not need to beware of too liberal feeding. During the first six months after weaning, many colts are permanently injured by too scanty a supply of food.

MANAGEMENT OF THE COLT

The notion is rather prevalent that colts should be permitted to rough it through all sorts of weather and on a scant quantity of coarse food, in order to develop hardiness and endurance, and that high feeding and good care may cause a colt which would otherwise be strong to grow into an unsound horse lacking hardiness and endurance. In many cases practical results have been such as to warrant this belief. It must not be concluded that there is anything injurious in generous and liberal feeding, or beneficial in starvation and exposure; but it should be evident that colts which are to attain sound and healthy development must always have pure air and abundant exercise.

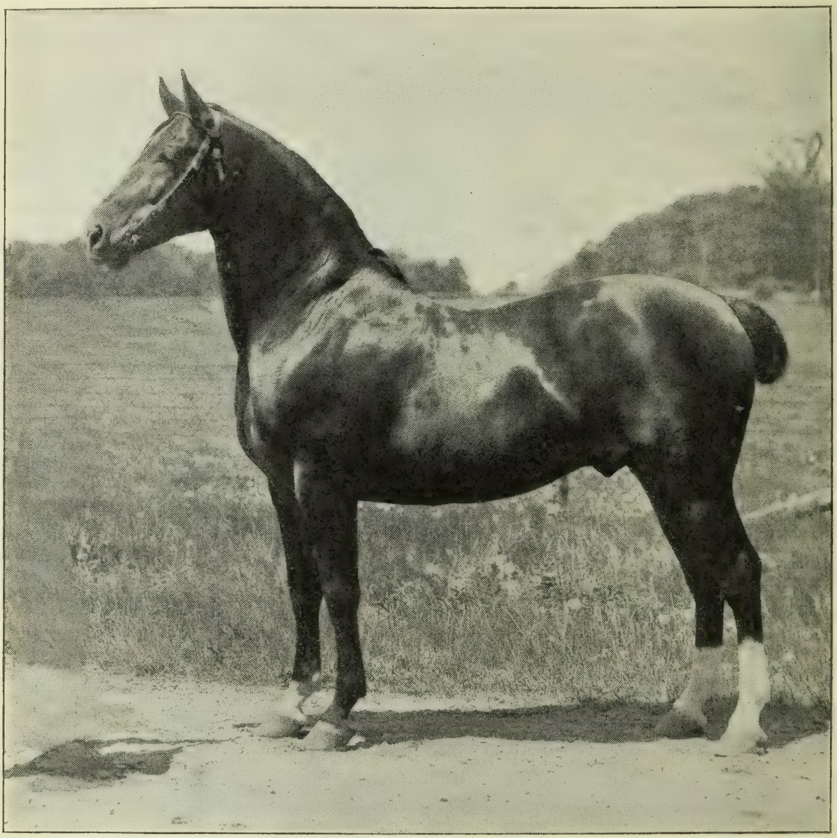

FIG. 47.— *French coach stallion, showing character*

Exercise and development

Abundance of fresh air and plenty of exercise are factors second in importance to no others in the raising of colts or horses. For this reason, working the brood mare both before and after foaling, working the stallion when possible, and permitting the foal to follow the dam into the field when convenient are practices to be recommended. The colt needs opportunity for abundant exercise in pure air, uncontaminated by stable odors — an essential to the healthy development of all young animals. It is not sufficient that it be led out for exercise at stated intervals. The foal needs an opportunity to romp and play in order that it may extend its muscles and expand its lungs to their utmost capacity, and send the blood coursing through its veins. Such exercise is essential to a healthy, robust development of heart and lungs and bone and muscle, and nowhere can it be obtained in so great perfection as in the freedom of the open field. A colt that is kept in the stall and fed on heating grains is seldom given an opportunity for this health-giving exercise. It grows up a stiff, clumsy animal, deficient in stamina and vigor. Breeders who follow the best practice promote the growth of the colt by an abundance of nutritious food, and further a healthy and perfect development by permitting it to romp, race, and play at will. If this practice is followed, all that is good in roughing will be attained and all that is dangerous in generous feeding will be avoided.

Care of the colt's feet

The feet of the growing colt should be properly cared for. If left to nature, the feet do not always become full, strong, and perfect. On stone or gravel, the foot wears off as fast as is necessary to keep it in fair proportions, but the wearing is not even. For this reason the feet of the colt should be carefully inspected once each month. As a rule it will be necessary to shorten the toes. The rasp is the only instrument that should be used for this purpose. When the toes are kept short the quarters will usually care for themselves, for the frogs will bear on the ground and keep the heels properly spread. The frog needs special attention, for if it does not come in contact with the bearing surface the foot will rapidly lose its shape, the heels will contract, and the walls at the quarter will become brittle, weak, and easily split both from above and from below. A split from above is difficult to check without firing or blistering; it is therefore important to protect the walls. The sole need not be cut in order to "open the heels." The walls should be kept rounded at the ground surface, the toe short, and the frog prominent.

A horse becomes unsound of limb when the weight of its burden is not equally distributed. Equal distribution of weight-bearing is possible only when the form of the foot and the direction of the limb are correct. Deviation from the proper standing position will cause a proportionate overtaxing of certain parts, resulting in unsoundness.

Sound feet are best produced by feeding nutritious food. Sudden changes of the food, periods of sickness, and exposure to cold, damp weather for months at a time have an injurious effect on the feet. Hence the colt should be fed regularly and generously, should be well sheltered, and should be protected as much as possible against the ravages of disease.

Castrating the male foal

There is a great difference of opinion regarding the best time to castrate the male foal. The work to which the colt is to be put, as well as the nature of the individual, is a factor to be considered. The longer he is left entire, the more masculine in appearance he will become. An animal that is castrated when young seldom develops an attractive head and neck. The longer he is left entire, the heavier and stronger his head, neck, and shoulders will become and the more courageous he will be. If, therefore, the colt is rather underdeveloped about the head and the neck and is rather timid in his nature, he may be left entire for six months, or even a year, longer than one that is overdeveloped and inclined to be vicious.

It is customary to castrate the foal when he is between one and two years of age. If let go too long he becomes staglike in appearance. Frequently it is desirable to castrate a stallion after he has performed services in a stud, but many owners are deterred from this practice by a mistaken idea as to the dangers of the operation and its probable effect on the temperament of the horse. The idea that castrating a horse will make him lazy and sluggish is entirely erroneous. The damages are slight, for the castration of a horse at any age is a simple operation; no injurious results need be expected when the operation is performed by a qualified practitioner.

Winter management

Weanlings should have snug quarters during their first winter. Preferably two of them should occupy a box-stall. They should be fed ground oats and bran — one fifth bran by weight — to which a little oil meal has been added in order to keep them in good physical condition. They should receive all the food that they will eat so long as they come back hungry for the next meal. Weanlings will eat three to five pounds of grain daily; yearlings, about seven pounds; and two-year-olds, about nine pounds. The grain ration of yearlings and two-year-olds may consist of corn meal, ground oats, and wheat bran, mixed equal parts by weight. Only the best hay should be fed, and that which is dusty and moldy should be avoided. Weanlings will consume daily approximately seven pounds of hay; yearlings, eighteen pounds; and two-year-olds, about twenty pounds. These figures represent averages; draft colts consume somewhat larger quantities, whereas lighter colts may consume considerably less. Colts that have free run of a small paddock in which they may romp and play will develop into strong, vigorous animals of undaunted courage and great endurance.

Too frequently colts are neglected and allowed to rough it from the time when they are weaned until they are caught to be broken. Many a breeder has failed of success by neglecting the colt. He has forgotten that all our improved breeds of horses are the product of adequate nutrition, as well as intelligent breeding, suitable environment, sufficient shelter, and kindly care. Many colts are thus stunted for the first winter, and no amount of feeding and care later on can fully retrieve such neglect.

In general, it may be said that when the colt is properly reared he will make approximately half his growth the first year. Of course there will be exceptions to this rule, but it will hold on the average when colts are cared for as suggested.

Summer management

On pasture, yearlings and two-year-olds should have grain according to the season and the growth of the grass. They should be kept growing, but not too fat. They should have shelter into which they may escape from the attacks of flies; it is difficult for colts to thrive when flies are prevalent unless this is done. Colts should not share a field with cattle, sheep, and swine if it can be avoided; they do best by themselves. The stallion colts will have to be kept apart from the mare colts after they are one year old; many a foal has been got by a yearling. Colts cared for in this way will not prove a disappointment to their owners, nor will the breeder lose interest in the business in which he is engaged. To see the colts thriving will ever prove a source of enjoyment as well as of profit.

TRAINING THE COLT

The colt should become familiar with man while young. In the very beginning he should be taught subordination and should not be allowed to become willful or headstrong. The usefulness of the horse will depend much on his courage and fearlessness, and it is in order to promote these characteristics that the colt should become familiar with man at as early an age as possible. If taken in time and properly handled, he need never know fear. A colt should never be frightened. Too many persons thoughtlessly try to tease the young colt by running at it or throwing sticks at it — practices which should never be indulged if a reliable animal is to be developed. The colt should be taught useful lessons only. Because colts are bright and susceptible to training, they are often taught tricks and allowed to become mischievous. A colt that bites, rears, or kicks may seem amusing at first, but this very behavior may later prove an annoyance that is difficult to overcome. The trainer should not make the mistake of trying to teach the colt too much at a time; he should be sure that it understands each lesson thoroughly before another is attempted. On the other hand, colts should be trained continuously day by day, and not merely at the convenience of the trainer. The trainer should be gentle and firm at all times and should accomplish whatever he attempts to accomplish.

Teaching the foal to lead

The foal should be taught very early the uses of the halter, first to lead, then to drive. But even before haltering, the colt may be taught to stand over, to have his foot raised, and to back. In handling the colt the trainer should be careful about the ears, the back of the forelegs, and the flanks, as these parts are often very sensitive. The colt should be caught by putting one hand under the neck and the other under the hams or around the buttocks; he should never be caught around the neck alone, for if this is done he will go backward and perhaps fall. If he attempts to go forward, press back with the hand under his neck; and if he attempts to go backward, press forward with the hand around the buttocks. Colts caught in this way will allow persons to walk up to them, whereas if they are caught around the neck there may be difficulty in catching them (Fig. 38).

When the foal is to be haltered, a strong, well-fitting halter should be chosen; it should not be a new one that smells strangely to the colt, but one that has recently been used. Care should be taken not to pull heavily on the nose-band at any time; occasionally deformed face lines and imperfect necks are caused by this means. It is not necessary to drag a colt by the halter in order to suggest to him that his business is to follow. After such treatment, the reverse effect is usual; the harder the colt is pulled, the harder he pulls back. If, on the contrary, he is coaxed along the accustomed route, for example to the watering trough and back, he will soon follow promptly.

If he continues to resist, however, other means must be tried. At all events the trainer should not stand in front of the colt and try to pull his head forward, for he will roll his eyes, shake his head, and step back. Advantage must be taken of the colt's natural tendency to step forward when pressure is brought to bear on the buttocks. A small rope, the size of a sash cord and about ten feet long, with a noose or a ring at one end, should be placed gently over the colt's back just in front of the hips, with the noose or the ring on the underside of the body. When the other end of the rope is run through the noose, the rope can be closely drawn around the flanks, passed along under the body between the forelegs, and then up through the ring in the halter. This is called the loin hitch. The trainer should pull gently on the halter strap with one hand,

and, as the colt begins to shake his head, give the light rope a sharp pull with the other hand; the colt will immediately step forward. If the colt is given time to become used to the lesson, he will soon follow wherever he is led. Some trainers prefer the quarters hitch rather than the loin hitch (Fig. 48)

Teaching the foal to drive

After the colt understands the uses of the halter and will lead, he may be taught to drive with reins. In order to do this successfully, a surcingle properly adjusted is required. The surcingle must be provided with loops or rings on each side, placed well below the center of the body; the lines should be passed through these and fastened to the rings on either side of the halter; a bit should never be used in the mouth of a very young colt. Now the lines will pass low on the hind quarters and thus prevent the colt from turning with his head toward the trainer. It is very important to hold the reins low in turning, in order to make the guiding process easy. As the colt becomes accustomed to being driven, he can be touched with

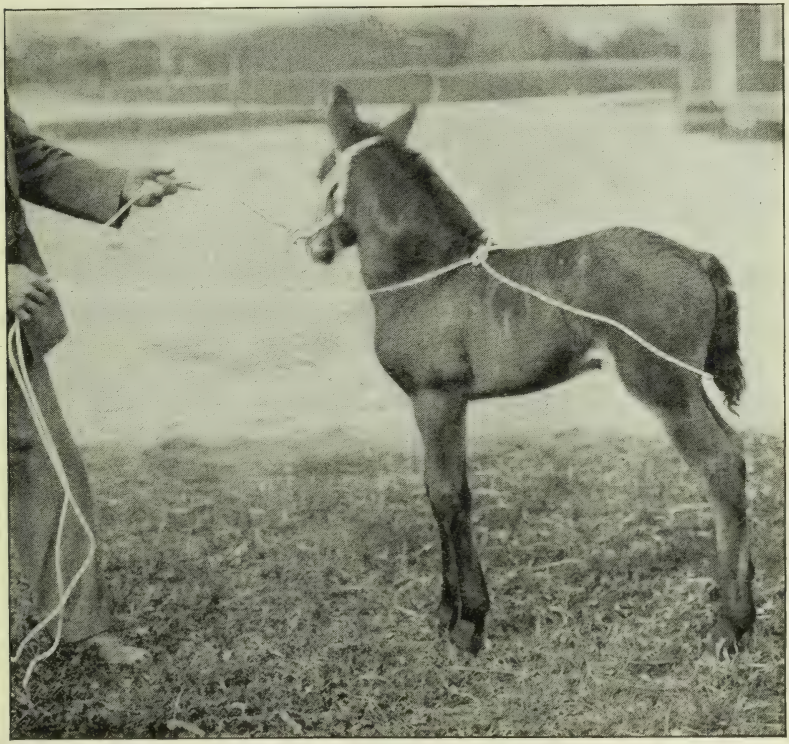

FIG. 48.— *Teaching the foal to lead*

the lines and guided to the right or the left; he should be stopped often in order to give him confidence.

There are two objections to training colts while young: first, because of lack of time on the part of the owner; and secondly, because after having been trained, the young animals are likely to be driven or put to hard labor before they are properly developed. For these reasons colts are usually allowed to enjoy their independence until such time as they are fit to work, and in many cases their general usefulness is much impaired by such practice. A horse should be reasonably mature before he is put to service, but time spent on his education prior to the date at which he goes to work will be repaid many fold in the more satisfactory manner in which he will perform his service.

Training to the uses of the bit.— It is perhaps best to train the horse to the uses of the bit when he is about two years of age. The manner in which the horse is educated to the uses of the bit will go far toward determining his usefulness. Inasmuch as the master's desire is conveyed to the mind of the horse through the medium of hands, reins, bit, and mouth, no progress can be made, and none should be attempted, until this means of communication has been established.

Importance of a good mouth.— No other factor contributes so much to the pleasure, comfort, and safety of the driver of a horse as a responsive mouth that promptly obeys the slightest instruction from the master. In general a good mouth is natural to the horse. A bad mouth usually results from improper handling, and often is the cause of many other imperfections, such as a tongue lolling, crossing the jaws, hobbling, and irregular and unsteady gaits, many of which, when well established, are difficult to overcome.

Bitting the colt.— The young animal can usually be made familiar with the uses of the bit by the application of the bitting harness, or dumb jockey as it is sometimes called. This bitting harness consists of an open bridle, with large, smooth bit, a checkrein, surcingle and crupper, and two side lines running from the bit to buckles on either side of the surcingle. The adjustment of the bridle is important. The length of the headstall must be so adjusted as to bring the bit in mild contact with the bars of the mouth. If the headstall is too short, the bars and the corners of the mouth soon become sore and the animal may become vicious; on the other hand, if it is too long, the bit drops down in the mouth and the animal becomes careless. With the bitting harness properly adjusted, the colt may be turned into the familiar open paddock in order to become accustomed to having the bit in his mouth. The checkrein and the side reins should be left slack at first. Gradually from day to day the reins should be shortened, although care must be taken that they are never made so short as to place the head in an uncomfortable position, or to tighten the bit and make the corners of the mouth sore. During a few hours each day for perhaps a week or less, the colt should be subjected to the use of this apparatus. The side reins may now be substituted for real lines, and the colt may be driven until he knows how to guide this way and that, to stop at the word " whoa," and to step forward at the command " get up." He should be trained to stand absolutely still when he is being harnessed or saddled, or at any time when it is desired that he should do so. A horse that is continually stepping about while being harnessed is but half-trained. The trainer should be gentle at all times, but he should accomplish everything that is undertaken.

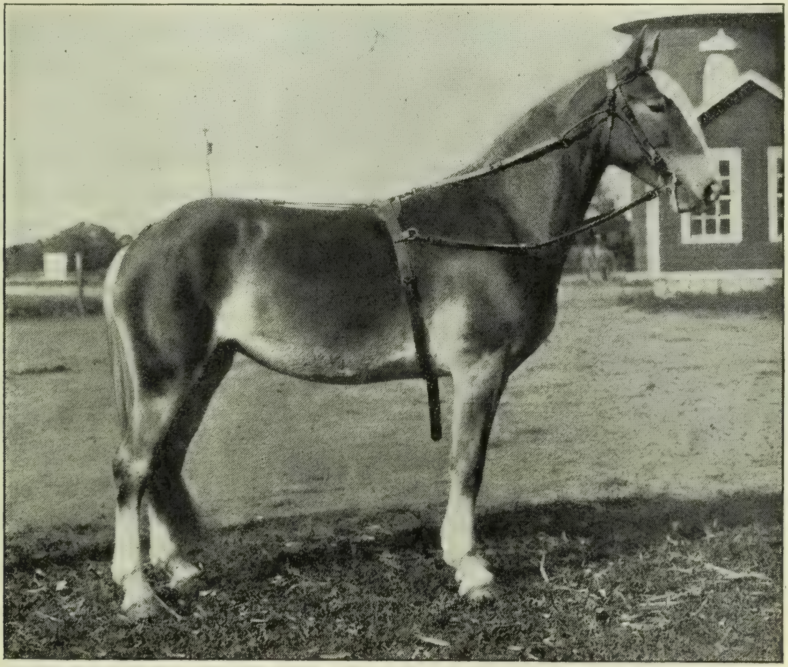

Fig. 49.— *Bitting harness, for teaching the use of the bit*

Poling the colt.— Before being harnessed or hitched, the colt should be made familiar with the pressure caused by the harness and the shafts. In order to do this, a light pole, eight to ten feet long, should be held for the colt to smell and to touch with his nose. The pole should be rubbed gently over the nose, the side of the face, and up to the mane and crest. After scratching the crest the pole should be brought back to the withers, down over the shoulders, and along the outside and inside of the forelegs. The pole should then pass along the back to the hind quarters, and down along the outside and the inside of the hind legs. The process should be repeated first on one side and then on the other, and every part of the body should be touched, until the colt becomes perfectly submissive.

Harnessing the colt.— After the colt has become familiar with the bitting apparatus and has learned to obey simple commands, he may be harnessed. Harness that has been in constant use, preferably by a horse that the colt knows, is desirable; new harness, smelling unfamiliar to the colt, must not be used. After the colt has been driven with the bitting apparatus and has become rather tired, he should be placed in his stall, the collar should be brought to him, and he should be allowed to smell it if he likes; then it should be adjusted as if he were an old horse. The trainer should take the harness, walk up to the colt, and lift it gently over his back. He should not stand off and throw the harness over the colt's back, for the loose straps, hitting the back and the abdomen, will be resented and the colt may kick. After the harness is adjusted the trainer should walk behind the colt, put the crupper strap on, and step to the side and fasten the bands.

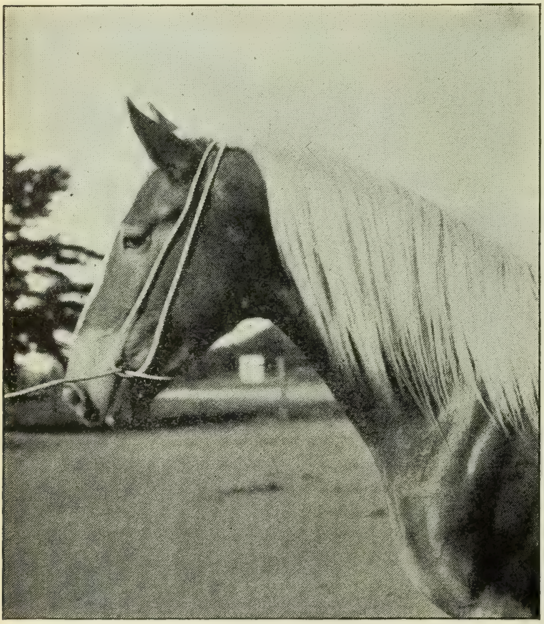

FIG. 50.— *War bridle, for leading vicious horses*

The harness should be of good quality and in good repair, and should fit perfectly; if a part breaks, the colt may be ruined for all time. The collar should receive special attention, since it is through this agency that the horse exerts his power, and the colt's shoulders are likely to be tender and easily abraded. The collar must be kept scrupulously clean. If the colt loses flesh, the collar which fitted perfectly in the beginning may become too large. A breast collar is admissible when the load is light. It must not be adjusted so high as to choke the animal, nor should it be so low as to interfere with the action of his limbs. The saddle and the crupper also need careful attention. Care should be taken to have them fit and to keep them clean, lest they abrade the back or the tail and render a horse vicious.

Hitching single.— When the colt is desired for single use, it is often advisable to train him to go single from the first. This may be done after he has become familiar with the bit, the harness, and the use of the lines. When training the colt to go single, a training cart, substantially constructed with long shafts and with a seat so arranged that the driver can mount and dismount quickly, should be employed. Such a cart can easily be constructed from the rear wheels and the axle of a buggy or a carriage by fastening two long poles (of hickory or any tough, springy wood) to the axle, a crossbar and a whiffletree in front, and a board seat in the rear. The shafts should be twelve or fourteen feet long, with provision at the ends for the attachment of a strap across from point to point in order to prevent the colt in rearing from throwing his front leg over the end of the shaft. At first a kicking strap attached to each shaft and passed over the colt's rump should be used, at least until the colt is accustomed to the shafts. When the colt is first hitched, an assistant should hold him until the driver is ready, and then he should be allowed to go. As soon as he has become familiar with the vehicle, he should be taught to stand still until he is told to go.

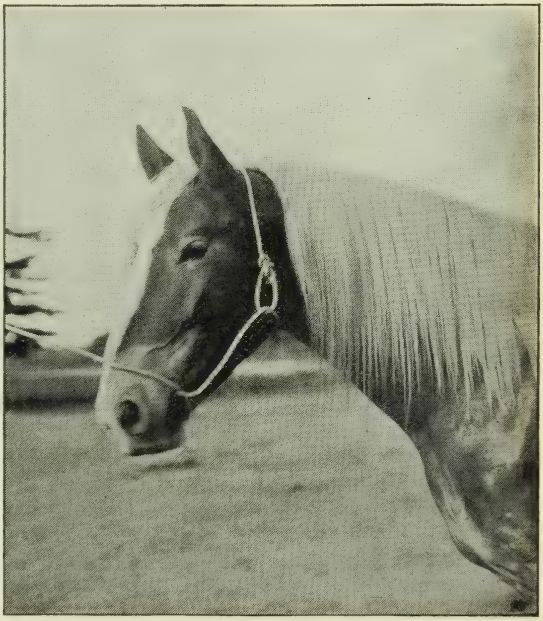

FIG. 51.— *Guy line for leading vicious horses*

Training the colt to walk fast.— There is no gait more valuable, more appreciated, and more practically useful in a horse than a fast, square walk. It is not difficult to train the average colt to walk fast, provided the proper methods are employed in early training. From the very beginning the colt should be walked as swiftly as he is able to walk, in order that he may form the habit of fast walking. He should never be allowed to mope along, or the habit will become strongly fixed.

Training vicious horses

In training or handling vicious horses, it is important to impress them firmly with the idea that the trainer has complete control over them and that they must obey. There are several ways of conveying this idea. Perhaps the most effective means is to contrive a self-punishing harness. With such a harness the vicious horse deals out his own punishment at the instant he violates his trainer's wish. While many appliances have been devised for the control of vicious horses, perhaps that invented by Mr. Rarey and used in his so-called "Rarey system" is as effective as any. This harness consists of two short straps fitted with D-shaped rings, a surcingle, and a long rope. The straps are buckled around the front pasterns and the surcingle around the body. One end of the rope is tied into the ring in the strap that goes around the pastern of the left, or near, front foot. The free end is then passed through a ring on the underside of the surcingle and down through the ring at the other pastern. Then the rope end is brought up and passed through a ring, tied about halfway down the right, or off, side of the surcingle. If the animal becomes unruly it is necessary only to pull on the rope, which brings his front feet up to his chest, and the animal comes down on his knees and his nose. A few hard falls will usually teach the most incorrigible, but such a dangerous practice should be followed only as a last resort

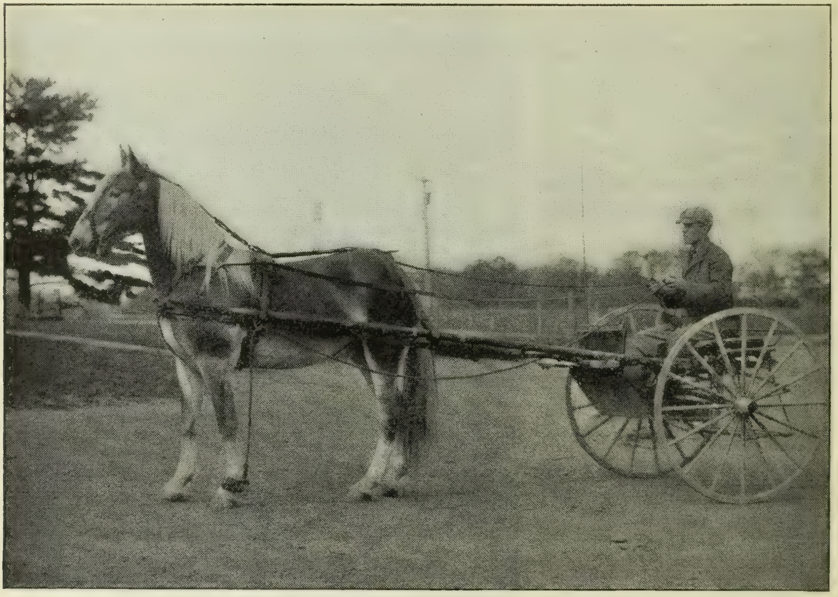

FIG. 52.— *Colt hitched for the first time, showing Rarey single safety and kick strap*

and after all other means have failed. It sometimes happens that horses permanently injure their knees or even break their necks as a result of a fall.

By the application of such methods, the most vicious animals can ordinarily be brought under control. If the horse with a disposition to kick, rear, bolt, buck, or run can be persuaded that he is merely punishing himself, he will soon understand that he must not indulge in such practices. It should be remembered, however, that such animals are not trustworthy and should never be left to the care of persons incompetent to meet an emergency.

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VOL. III. No. 56 JANUARY 15, 1914 THE HORSE SERIES No. 3

PRACTICAL HORSE-BREEDING

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1. How many stallions are standing for public service in your county? To which breeds do they belong?

2. Which breed of horses is most popular in your vicinity? Why?

3. What are the more important disadvantages of breeding horses in your vicinity? How can such difficulties be overcome?

4. Name the more important causes of sterility and abortion in mares. What can be done in order to avoid some of them?

5. Name the common ailments of young foals. What can be done in order to avoid some of them?

6. At what age should the colt be put in training? At what age should he be put to work? At what age should the colt be put on the market in order to realize greatest profit?

7. Name the principal market requirements of the horse.

8. Name a few of the more important defects that are likely to detract from the value of a market horse.

Name.................................

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COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

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PLANTING THE HOME VEGETABLE GARDEN

Albert E. Wilkinson

Before the plan* for the garden can be worked out on paper, a site must be chosen. Many factors enter into the question of choice of site.

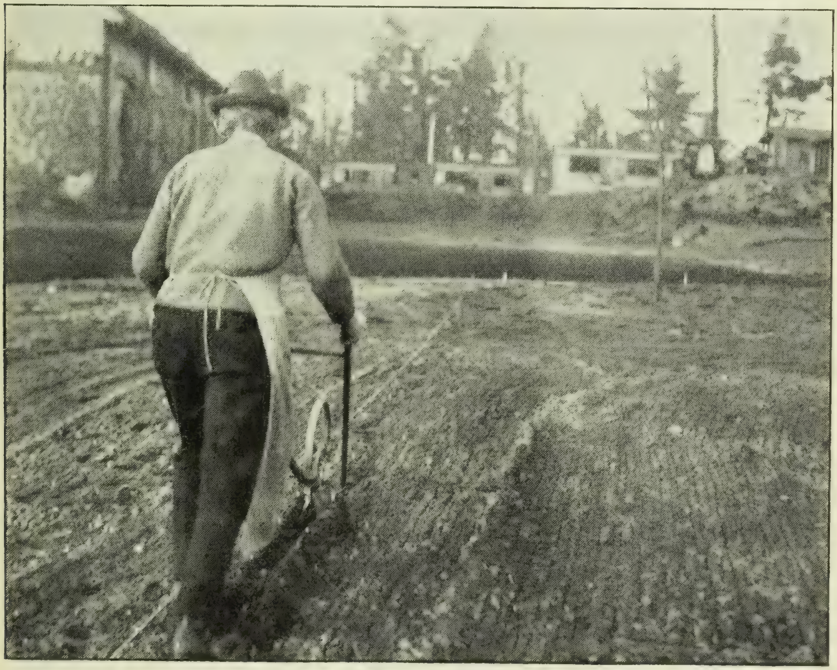

Fig. 53.— *Opening the furrow with a wheeled plow*

SITE AND SOIL

As a rule, the home garden should be near the house, where it will be free from intruders, convenient to the home water supply, and easily accessible in the work of harvesting. Such a situation would likewise facilitate the work of cultivating, since the farmer is more likely to stop and stir the soil in a garden that is near at hand than in one that is at some distance.

**See* Cornell Reading-Course for the Farm, Vol. II, No. 34, Vegetable-gardening Series No. 2, Home Garden-planning.

The slope of the land should be considered. In general, land that slopes is preferable to a flat surface. The former will afford ample water drainage and may afford air drainage. If, however, the land is flat and lacks proper water drainage, tile may be laid to carry off the surplus water. A single line of tile drain running through the garden may be sufficient, especially if each tile has the proper fall, or pitch. A southeastern slope or exposure is most desirable, for it warms up earlier in the spring and so makes possible earlier crops.

Some *protection from sweeping winds* should be provided, or loss of moisture and delay in maturity may result. A building, an artificial windbreak, such as trees or shrubs, a hill, or other means of protection will answer. The barrier should be on the side toward the obnoxious wind.

Shading from trees, houses, barns, or other large structures should be avoided since it results in spindling and unsatisfactory growth. Roots of trees along the edge of a garden frequently injure plantings by drawing moisture from the soil.

One of the most important factors in the choice of a garden site is the *texture of the soil.* Texture means the size of the earth particles entering into the composition of the soil. Sandy soils are composed of coarse particles, and clay soils of very fine particles.

Another factor of importance is the *moisture in the soil.* The smaller the particles of the soil are, the greater is its water-holding capacity. Sandy soil, therefore, is well drained but suffers more during drought than do clays or silty soils.

A third factor in determining the site of the garden is *soil temperature.* Soil temperature largely depends on the water content and the air content of the soil. A very moist soil is generally spoken of as cool. If air penetrates the soil to some depth, it has a tendency to warm the soil quickly in springtime. Clay soils, therefore, which are saturated with moisture, are relatively cool, whereas coarser sands with their supply of air are warm. The color of soil also has an influence on its temperature. It is known that dark soils absorb heat, whereas light soils throw off or reflect the sun's rays. Moisture and air will frequently counteract the influence of color.

Choice of soil also is an important consideration. For most vegetable-gardening, a sandy soil is preferable to a clay soil. The several advantages of sandy soil over clay may be enumerated as follows:

1. Sandy soil warms up earlier in spring, and tillage can be undertaken earlier.
2. A high temperature is maintained, and tillage can be continued later in the fall.
3. Sand responds to irrigation, for it absorbs water more quickly.
4. Sand dries out more quickly after rains.
5. Fertilizers give quicker returns on sandy soil.
6. Tillage and transplanting may be accomplished more easily.
7. Root crops are more easily harvested.
8. Root crops are better formed and are freer from earth particles.
9. The expense of cleaning and preparing crops for use is curtailed.

From the foregoing enumeration it will be seen that the use of sandy soil means a saving of expense and labor, since such soil yields products in greater quantity and of higher quality.

As sandy soils differ in quality, the needs of the gardener must determine his final choice. If he desires an early-producing soil, he should choose coarse sand, if possible, as such soil absorbs the warmth of the sun more quickly than does other soil; it is well drained and it responds readily to irrigation. As a result of these characteristics, seed planted in coarse soil early in spring will come to an early maturity. Soil of this kind, however, requires liberal and repeated applications of humus-making material, either in the form of stable manure or green-manure crops. Such applications involve expense, and the material has to be plowed under yearly.

A medium sandy soil usually contains more plant food than a coarser sandy soil. It requires less irrigation since the finer soil particles retain moisture for a longer period of time. Medium soil is not so early-producing as a coarser type, however, nor is it so productive as a finer type.

Fine sands constitute the most productive trucking soils. They require less expense in maintaining fertility and at the same time have the advantages possessed by medium soils.

PREPARATION OF THE SOIL

Fertilizing

After a piece of ground of the best texture, moisture, and temperature has been chosen, the next important step is to apply fertilizing material. As a rule, commercial fertilizers are of questionable value in the home garden. The garden would be much improved if yearly applications of stable manure were depended on rather than applications of commercial fertilizers.

One is not likely to apply too much manure to sandy soil. Near the large cities of the United States, some of the best gardens receive as much as forty or fifty tons of well-rotted manure to the acre, and others receive far more. Fresh, coarse manure is best applied in fall or very early in spring, and should always be plowed under. Well-rotted manure is best applied just previous to planting and may be covered by shallow plowing or be worked into the soil by harrowing. The gardener must consider that manure does more than supply food for the plant; it increases the water-holding and the air-holding capacity of the soil, it promotes root development, and nourishes beneficial bacteria.

Plowing

Manure should be plowed under, thoroughly harrowed, and mixed with the soil. The plow should turn the furrow over so that it will lie on edge and not be flattened. A disc harrow operated in the direction of the furrows should follow the plow. Heavy soil or sod land requires cross harrowing. Such an operation should be conducted by lapping half the width of the machine on the worked area. Finer harrowing, such as is effected by the spring-tooth, the spike-tooth, or the Acme harrow, should follow. A fine, smooth surface may be obtained by hand raking or by the use of the Meeker harrow and leveler. The Meeker proves an excellent substitute on a large acreage where hand raking is not practicable.

If better tilth is required, the method of backfurrowing may be practiced. The soil is plowed as before, either in fall or very early in spring. Just before planting, it is plowed a second time to a depth of four inches. The plowing is best begun in the middle of the garden. The furrows should be thrown against each other; that is, as the plow moves from north to south, the first furrow is thrown to the west; and as the plow returns from south to north, the new furrow is thrown towards the east, over against the first furrow. Hand raking may be begun after four furrows have been turned. All coarse material should be raked into the dead furrows. When the work of plowing and raking has been carefully done, the topsoil to the depth of four inches will be in fine condition for planting or cultivating. Backfurrowing is one of the best intensive methods for the production of crops. It is expensive, but it is justified by the returns received from the crops grown.

Hand digging

Frequently horse plowing and harrowing is impossible, and the garden lover has to use a spade or spading fork for the rough work of preparing the garden. In using either of these tools, it is advantageous for the gardener to work systematically. If the longer dimension of the garden is north and south and the digging is to be done from east to west, he should begin at the southwest corner, take out and invert one shovelful of soil, and crush the clods with the back of the blade. After the operation has been continued in a straight line to the southeast corner, the work should show a ridge of loose soil, a trench three or more inches deep, and a line of unbroken ground. Throughout the digging these conditions must be maintained; the ditch between the loose soil and the hard ground should be given especial attention. After the first row, one spade wide, is dug, the operator may return to the southwest corner of the field or work back from the southeast corner. When six or seven spade furrows have been turned, the soil may be raked. This operation consists in breaking the lumps of earth and removing sticks, stones, and other rubbish. It leaves the soil mellow and level, and ready for the work of planting or transplanting.

SOWING SEED OUT OF DOORS

The time for sowing

The best time for sowing is a question to be determined by experience. No definite date can be depended on year after year, or even for two years in succession. The time for sowing depends on soil moisture, soil temperature, and climatic conditions. Conditions of moisture and temperature are found to be more nearly correct in soil that has been freshly stirred before planting than in soil not stirred. Climatic conditions are likely to become settled about May 1. At this time, the soil is in condition for the most rapid growth of plants. Cold-weather plants may be planted much earlier in the season. Warm-weather crops must wait until all danger of frost is past. Farm Reading-Course Lesson No. 34 affords more specific information on this subject.

In addition to moisture, temperature, and climate, one other factor must be taken into consideration — the time for marketing. When is the produce wanted in the home? A definite period of time is always required between the sowing and the harvesting of a crop. If the period is carefully estimated, seed may be sown so that the supply will begin early and continue regularly throughout the season. On this question, also, experience is the best teacher.

Seed-testing

Seed should be tested in order to determine its viability, or power to grow. The test may be made in a number of ways. Perhaps the saucer method is the simplest and the cheapest for the home gardener. Blotting paper or fine sand should be placed in a saucer or a pie plate and moistened with water. Twenty-five seeds of any variety should be placed on the blotter, and the saucer should be covered. If the seeds have warmth and are watered occasionally, growth will begin in a short time. If in the course of ten days to two weeks, twenty seeds out of the twenty-five have germinated, eighty per cent of the seeds are good. If less than sixty per cent have germinated, it will be necessary to increase the number of seeds planted in each drill or furrow. It is a great satisfaction to have ascertained just how large a percentage of seeds will germinate.

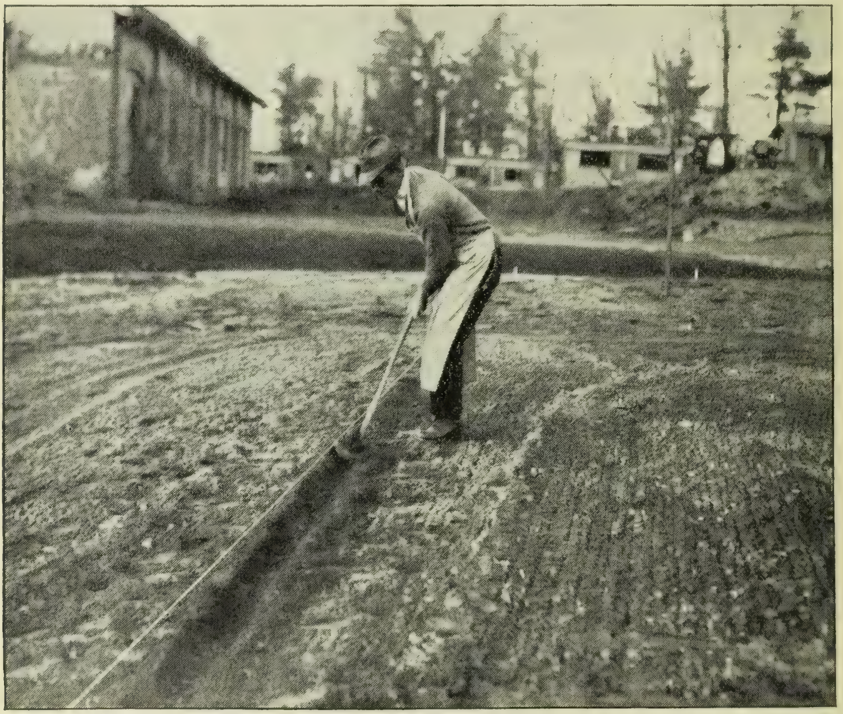

FIG. 54.— *The garden hoe, used to open the furrow*

Quantity of seed to sow

The rate of sowing seed should be gauged so as to produce a uniform stand without the crowding of plants and without necessitating undue labor. Only the best seeds should be sown, even if they have to be screened and half the quantity bought thrown away. The tables in Farm Reading-Course Lesson No. 34, pp. 80, 88, and 92, show the amount of seed required to plant a hundred feet of drill. This table is the result of investigation of the quantity of seed to be sown under certain conditions. In using the tables, it is necessary to take into account the following factors:

1. The date of sowing: the earlier the sowing is done, the greater is the quantity of seed needed, since some of the seed will be wasted.

2. The physical character of the soil: Clayey soils require more seed than sand soils, since the seedling is often injured in its endeavor to break through the ground. The seedlings of such seeds as carrots, parsnips, and beans are especially liable to injury.

3. The size and vigor of the plantlets: carrot and parsnip seedlings are weak and are not able to push through a compact clay soil.

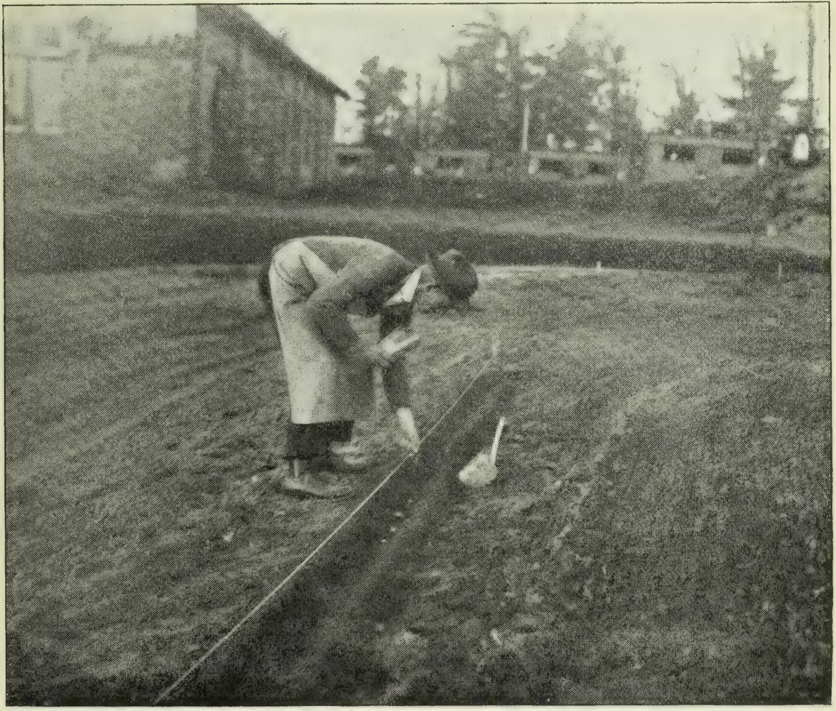

Fig. 55.— *Planting the seeds in the previously opened furrow*

4. The viability of the seed: the proportion of seed in a given package that will germinate may be ascertained by testing the seeds.

5. Expense of thinning: the thinner the seeding is, the less expensive is the thinning.

6. Insect pests and diseases: if insects and diseases are prevalent, more seed will be required. Even if seedlings are thoroughly sprayed, insects must eat of the foliage in order to obtain any of the spray.

7. Manner of sowing seed: If a crop is to mature where it is sown, seed should be used sparingly, and the plantlets should be thinned to

the required stand after germination. If plants are to be shifted, much thicker sowing may be practiced.

8. Demands of the home: if the housewife requires beets in June, they should be ready to use at that time.

An application of these principles to the home grounds will not be difficult if an estimate of the amount of seed required is made. The table in Reading-Course Lesson No. 34 will assist the gardener in making such an estimate.

Soaking the seeds

The first process in germination is the absorption of water by a seed. This enables the tiny plantlet within the seed coats to become active. It is possible to advance germination a few days by soaking the seeds over night in warm water. On the following morning they should be carefully planted by hand in order to avoid bruising.

Sowing broadcast or in drills

Seed may be scattered evenly over a surface, that is, broadcasted, or it may be distributed in straight and evenly spaced furrows, or drills. While broadcasting is more rapid, the method is seldom advisable unless the soil is in exceptionally fine condition and free of weed seed. The advantages of the drill system over broadcasting are as follows:

1. The seed is sown at a uniform depth.
2. The percentage of germination is greater, because seed sown in drills makes a united effort to push through even a clay crust.
3. Straight seedlings are produced in an orderly arrangement, because each seedling is given its proper amount of space. This enables transplanting to be affected much more rapidly.
4. Seedlings grown in drills are easier to thin.
5. Water may be applied on the soil between the rows. Broadcast sprinkling is undesirable if there is a tendency toward damping off.
6. It is possible to cultivate the soil, as there is a regular and definite space between the plants.

Depth of sowing

According to the "gardener's rule," seed should be sown at a depth twice its diameter; but judgment must be exercised in the application of the rule. A table given in Farm Home Reading-Course Lesson No. 34 has answered this question in detail. The question of depth depends on at least four factors, of which the first is size. The larger the seed is, the deeper it should be planted. Beans may be planted at a depth of an inch or an inch and a half; celery or carrot seeds are merely pressed into the soil. The texture of the soil is a second factor. If the soil is sandy, the seed may be planted at a greater depth than if the soil is clayey. A third factor is moisture. A dry soil requires deeper planting than a moist or a well-irrigated soil. The fourth factor, which is the season of the year, influences the third factor. There is more moisture in the soil in early spring and during late fall than in summer. Seed sown at these seasons should be nearer the surface than seed sown in summer, since the absence of moisture in the topsoil demands deeper planting.

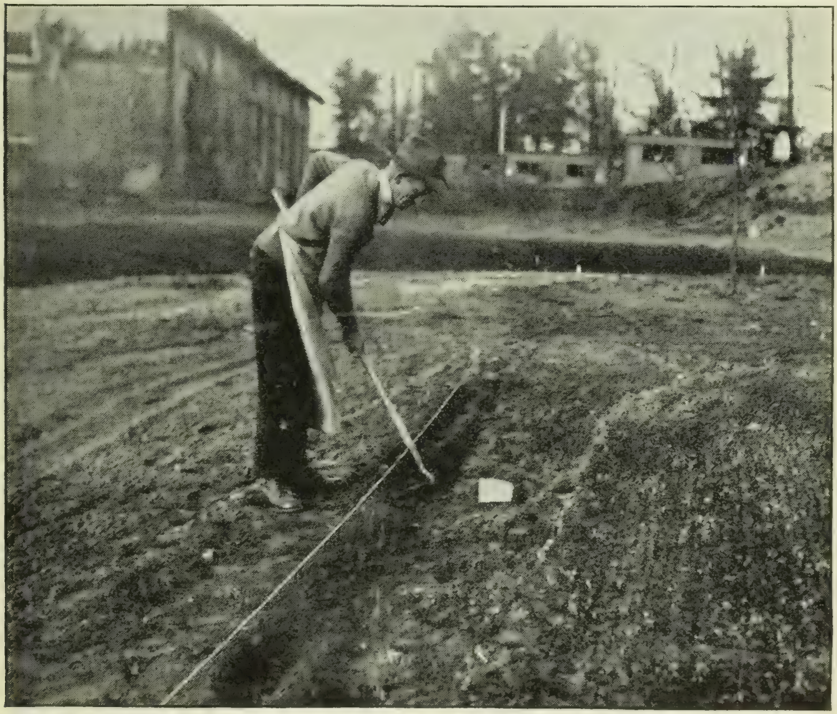

FIG. 56.— *Covering the seed with soil*

Hand sowing

In the home garden straight rows are practically a necessity, not only for better appearance, but for economy in space. Crooked rows are unsightly, space-wasting, indicative of shiftlessness, and should never be tolerated.

In hand sowing the first step is to mark off the row. A line may be used, or a homemade marker aided by a line will answer the purpose. The marker may consist of a handle and a piece of board, or scantling, with pegs at required distances apart. After these marks, or lines, have been made, the next step is the opening of the furrow. This may be done with a hoe, or with the plow attachment on one of the man-power wheeled tools. The latter is the more reliable, since it opens the furrow to a uniform depth, whereas the hand hoe varies the depth. After the furrow is opened, it is necessary that the seed be sown and immediately covered before the soil has dried. The soil should be plowed over with a one-man-power machine or worked back with a hand hoe, and should be firmly pressed down. This system of sowing is employed in the home garden but is fast giving way to the next mentioned method.

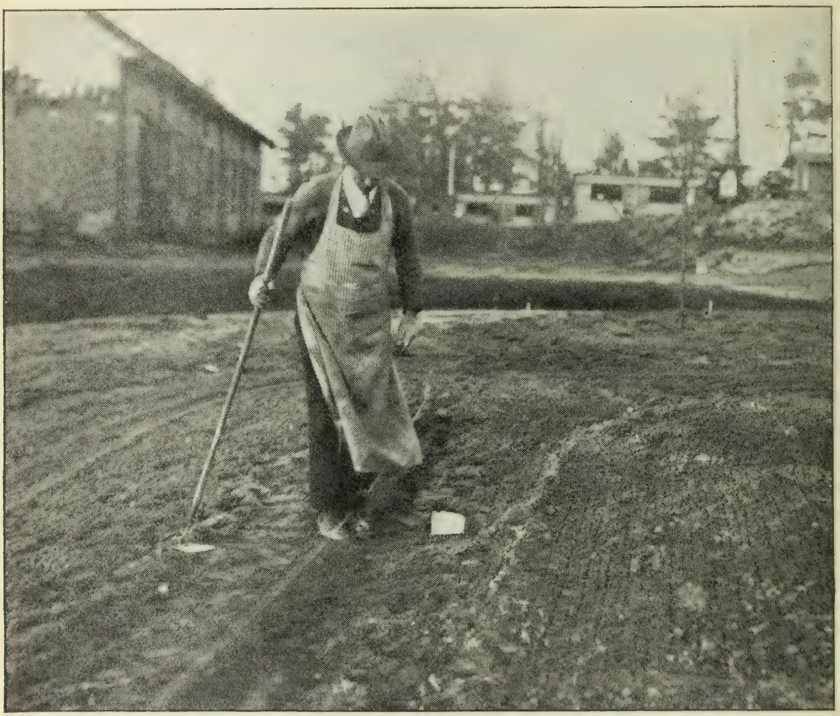

FIG. 57.— *Firming the soil around the seed, and thus making more points of contact between seed and soil*

Machine sowing

A hand drill used for sowing saves much time. In one operation such a machine (1) opens the furrow, (2) drops the seed, (3) covers the seed, (4) presses the soil, and (5) marks the next row. The work proceeds as swiftly as the operator can move. The cost of a drill is so reasonable that its use can be recommended for the larger home gardens.

Firming the soil

It has been noted that the soil thrown back on the seeds must be firmly pressed down. In hand sowing, a clay soil may be pressed down with the hoe; sand will require foot pressure. The gardener should tread the soil with feet close together until it is firm.

When a machine is used for sowing, treading is unnecessary in a clay soil; but on coarse, sandy soil the operator will find it advantageous to supplement the rolling of the machine with foot pressure. In his book on market gardening, Peter Henderson states that foot pressure is a most important operation in the growing of vegetables, since it produces a greater number of points of contact between the seed and the particles of the soil. As a result, the seeds absorb water, life is stimulated in the protoplasm, and the embryo begins to develop. Foot pressure favors root growth and enables the plantlet to gather moisture and food from the soil with greater ease. By the home gardener it should be considered as a requisite of good gardening.

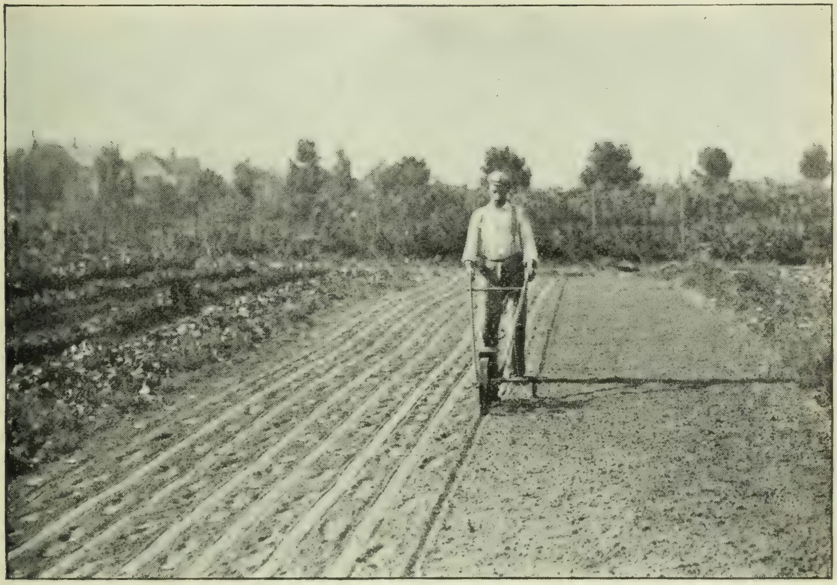

FIG. 58.—*A modern seed drill, accomplishing the four previous steps in planting in one operation and as fast as a man walks. At the same time it marks the next row*

Watering

An abundant and constant supply of water is absolutely necessary in order to produce large crops of vegetables. Germination will be greatly aided if irrigation follows directly on sowing. The common hose, the Skinner System,* or some other simple method may be used. Such an operation provides for the proper swelling of the seeds and the subsequent growth of the plantlet. The importance of irrigation is being realized increasingly every year. It will render the operator of vegetable gardens practically independent of rainfall.

Shading

Sometimes it is advisable to shade the ground in which seeds have been planted in order to prevent undue evaporation of soil moisture. This practice is well adapted to the home garden. If newspapers, old carpet, burlap, or lath screens are spread over the soil, they will check the sun's rays or the sweep of the wind. These materials will not only hinder evaporation, but also will prevent the formation of a crust that might interfere with plant growth. As soon as the young plantlets break through the ground, the covering must be removed immediately, for otherwise, the plants will grow spindling.

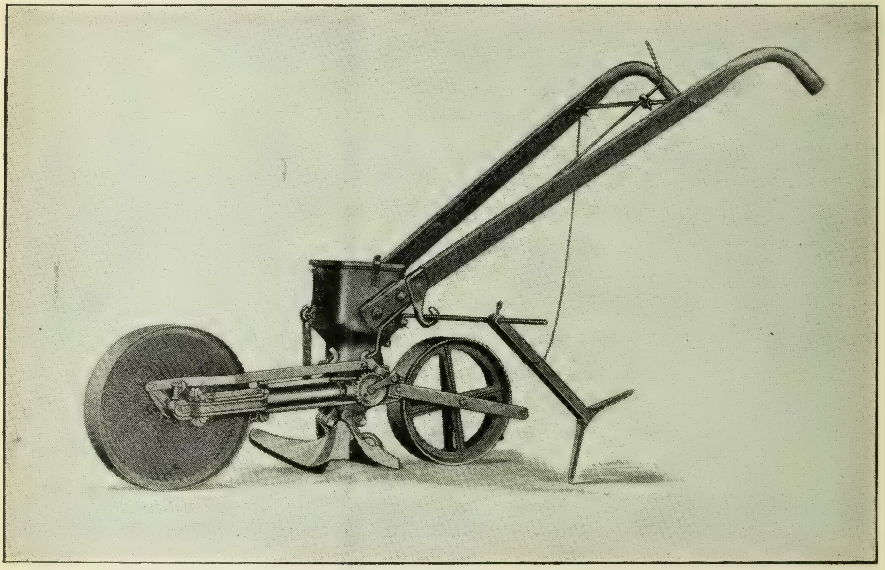

FIG. 59.— *One of the many good types of seed drills*

Thinning

The next step is thinning, a process which aims to remove plants that are weak or spindling and to give to the healthier plants the required space for proper development. The result is a uniform stand. The process of thinning is wearisome and expensive, and it may be lessened somewhat by a more even and thinner distribution of the seeds.

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* Lesson 4 of this series will discuss the Skinner system.

PLANTING UNDER GLASS

Planting under glass takes place in the living rooms, or in hotbed, cold frame, or greenhouse. It is not the purpose of this lesson to deal with the sowing of seed in large greenhouses, but to trace simpler methods that may be applied to the home garden.

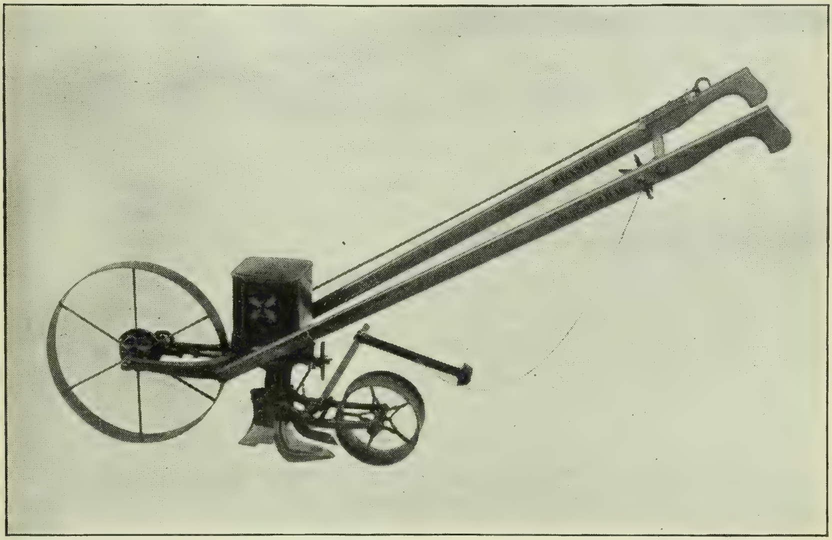

FIG. 60.— *Another desirable type of seed drill*

Plantings should usually be made in a shallow box, or flat, as it is called. A flat has the following advantages:

1. All the work can be done in a warm room.
2. This work is independent of outside weather conditions.
3. The control over moisture insures better plants.
4. There is a uniform number of plants in each flat.
5. It is convenient to handle the flats at the time for transplanting.
6. The plant has more roots when transplanted to the garden.

Flats may be made from boxes obtained at the store, or they may be made out of chestnut boards, a more durable material. The sides and bottom of each flat should be of one-half-inch stock, and the ends of three-quarter-inch stock. The outside measurements of flats to fit frames may be thirteen by eighteen inches. The inside depth should be two and one half inches. If this size is used, ten will be accommodated under each hotbed or cold frame sash. Other dimensions may be better for other situations. There should be cracks about one quarter inch wide in the bottom of the flats.

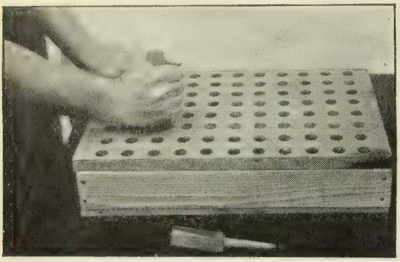

FIG. 61.— *Transplanting board and dibber in use*

The soil

Prepared soil should be placed in the flats. It may be made by composting equal parts of well-rotted horse manure and sandy garden soil; or the materials and proportions may be varied to meet special cases. A pile of the required size is made by placing on the ground a layer of manure about three inches thick. A similar layer of sandy loam should be added, and the operation should be repeated until the sides of the pile are square and the top is flat. This pile should be turned several times during the season. In fall it should be screened and stored so that small quantities may be easily obtained during cold weather. For fine work, a screen with a one-quarter-inch mesh is desirable; for coarser work, a half-inch or one-inch mesh is preferable.

Other composts may be used, such as one part leaf mold, two parts sandy loam, and one part horse manure; or one part rotten sod, one part leaf mold, one part horse manure, and two parts sharp sand. Garbage, garden waste, lawn-rakings, leaves, and other substances may be utilized in the compost.

Marking

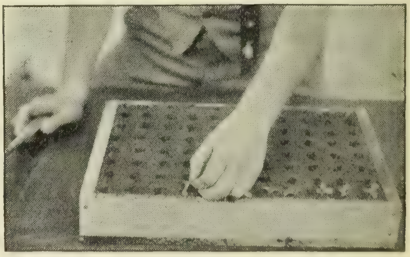

FIG. 62.— *The seedlings are placed carefully in the punched holes*

The soil in the flat should be level in order to prevent uneven watering. The practice of the writer has been to fill the flat and level the top with a board. A small piece of wood, which is the exact length of the inside dimension of the flat, is used to mark the rows. It should have a sharp edge and be pressed far enough into the soil to make a furrow. For most seeds the furrow should be about one quarter inch deep, but for celery and other small seeds it should be not over one eighth inch. The first row should be parallel to, and one half to one inch from, the side of the flat; the remaining rows should be one to two inches apart; according to thickness of sowing and time of transplanting. It may be better to mark the first and last rows, and then the middle rows.

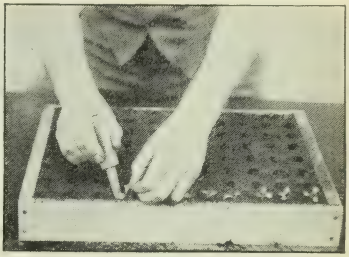

FIG. 63.— *The soil should be firmed against the roots of the transplanted seedlings*

Sowing and care

Seed is now sown in the furrows at rates varying from five to fifteen seeds per inch, according to the percentage of germination and the length of time seedlings are to remain in the flat. Evenness of sowing is most important. Some persons prefer to sow seed from the hand, working it over the index finger with the thumb. Others prefer to use an envelope, cut squarely at the end. The seed is shaken out over the flat edge, not the corner, with a gentle swinging motion *parallel* to the row.

After the seed is sown, the soil is leveled over the rows and pressed down with a board. If the surface is not perfectly level, water will run to the low spots and cause uneven growth. The soil should be watered thoroughly and placed in a proper temperature for germination. After the flats have been placed in a cold frame or a hotbed, or in the house, proper conditions of temperature should be maintained, according to the variety of the plant. For lettuce, cabbage, or cauliflower, a temperature of 50° to 60° F. is satisfactory; for tomatoes and other tender plants, 75° to 80° F. is required. After germination, the temperature should be reduced for the latter group and may be lowered for the former.

Ventilation must be considered as well. It is highly important that the sash of the hotbeds or cold frames be opened daily. A little fresh air for a short time is beneficial even in cold weather.

Watering requires skill and the closest attention. No rules can be laid down and experience must be the teacher. Too much water renders the soil soggy, either causing a rapid, tender, spindling growth or checking growth entirely. When too much moisture is present, damping off, a fungous rot, frequently attacks plants at the surface of the soil.

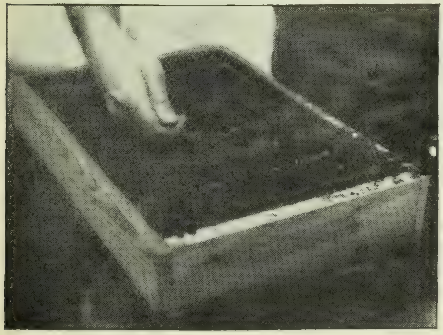

FIG. 64.— *Sowing seed with the thumb and the index finger. This method may be used in the open as well as in the flat*

Insufficient watering dwarfs the plant. Uneven watering results in uneven growth. It is usually best to water the plants in the morning, but on bright days later applications may be needed. The plants should dry off before nightfall. Thorough and less frequent watering is better than light sprinklings often repeated.

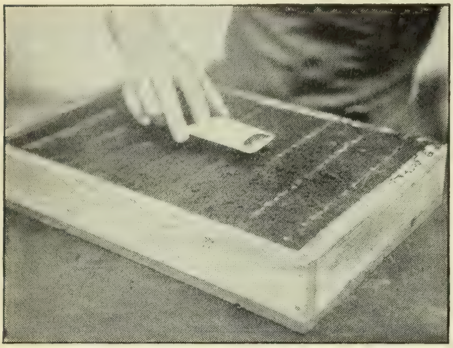

FIG. 65.— *Sowing seed from the package with a swinging motion*

Transplanting seedlings

After three or four weeks, the first true leaves appear on the seedlings, and the time for transplanting has come. The flats that contain the seedlings should be thoroughly watered several hours before transplanting is begun. This procedure will aid in the removal of the plants, and a greater amount of root surface can be removed with each individual. The new flat should be filled with soil and leveled as before. A planting board, perforated with holes at equal distances, may be placed over the flat, and a dibber, or round stick, slightly smaller in diameter than the holes and shouldered, may be thrust through each hole into the soil. If the soil has sufficient moisture, it will remain as punched after the board is removed. In each hole a seedling should be placed, and the soil should be firmly pressed against the roots, with fingers or dibber. The latter is especially useful in securing close contact between the soil and the lower root. Care must be taken to set the seedlings in the flat at a uniform depth. Another simple method of transplanting is more commonly used. The rows are marked with a stick. A dibber in the right hand opens a hole, the plant is set with the left hand, and dibber and fingers are used to firm the soil about the roots as before — three distinct motions in all. If the

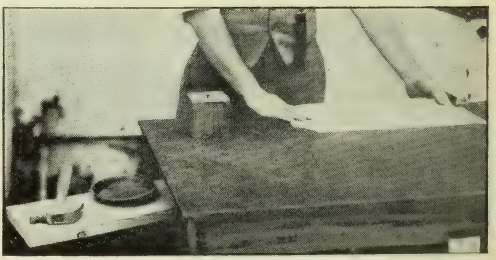

FIG. 66.—*The making of paper pots. The wooden block on which the paper is folded is fastened to the table top by a steel bolt. To the right of the operator and below the table is a shelf on which lies the hammer and the saucer of tacks. The sheets of paper to be used should lie to the left of the block. This arrangement allows freedom of movement to the operator in folding the paper*

soil is a little dry and the weather is bright a slight application of water, directly after transplanting, may also benefit the plant.

Seedlings may be transplanted into pots of various kinds. Earthen or paper receptacles are equally satisfactory for this purpose. The soil for pots is prepared as for flats. It should be tamped down by slightly raising the pot and dropping it quickly two or three times. The small seedling may be placed in a hole made with the finger or the dibber. An expert transplanter partly fills the pot with soil, holds the seedling in one hand, and presses the additional soil firmly against its roots.

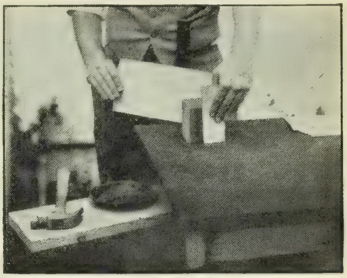

FIG. 67.—*The paper should be folded around the block. Second step*

Seedlings may be transplanted to hotbeds or cold frames. Some system of marking should be employed in order to make the rows straight. The plants are set at short intervals in holes made with the finger or with a wooden dibber. From this point on the treatment is similar both for hotbeds and for flats.

Care following transplanting

For the first day or two after transplanting, most plants need shading in order to check evaporation of water from the leaf surface. If shading is not provided, it may be advisable to remove some of the leaves from the plantlets in order to check the process. The shading of plants after transplanting may be accomplished by the use of paper, cloth, or lath screens. Shading will result in lessened evaporation, will increase the growth of roots, and thereby balance the loss of moisture from the leaf surface.

Especially during the first week or ten days after transplanting, a careful watch of the plants is essential. If possible, bottom heat should be given to the pots or flats. In that case the ventilation on the surface of the soil must be greater. In very cold weather it is important to protect the plants in hotbeds or cold frames by the use of mats or a double glass sash. If mats are used, they should be placed over the beds about four o'clock in the afternoon and allowed to remain until the sun is well

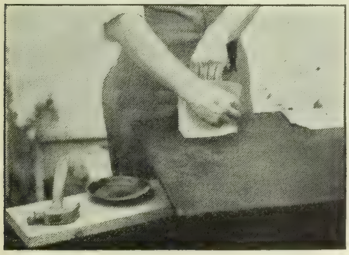

FIG. 68.—*The position of the operator's left hand should be noticed. The corner of the paper is held firmly and is bent back across the top of the block*

up in the morning. The double glass sash will give as good results as single sash and mats, if not better, and it will save the expense and the trouble of handling mats.

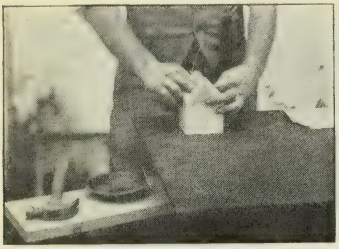

FIG. 69.— *Opposite corners of the paper bent down, forming the bottom of the pot*

Hardening plants

As the season advances towards the time when the plantlet can be successfully transplanted to the garden, it should be prepared to withstand the change from its coddled condition in the greenhouse or frame to the more rigorous conditions of the open field. It is important that this hardening be brought about gradually. Water should be used sparingly, and from day to day the temperature should be lowered by a gradual increase of ventilation until the sashes are left off entirely. The temperature will be further reduced by discontinuing the use of mats. The process of hardening requires skill and detailed care. The best results can be obtained only after the operator has had some experience.

Transplanting to the garden

The reasons for transplanting vegetables are as follows:

1. Some crops mature earlier if they are first planted under glass and later transplanted to the garden.
2. There is a concentration of operations, when seed is planted in flats.
3. Less expense is involved in fighting weeds, insects, and diseases in a small seed bed than in a large garden.
4. In small beds, it is possible to provide ideal conditions for plants that require nursing.
5. Transplanting permits the use of the ground for another crop earlier in the season.
6. Transplanting develops a larger and a better root system on the plant.
7. Transplanting tends to increase the earliness of some plants, especially the tomato.

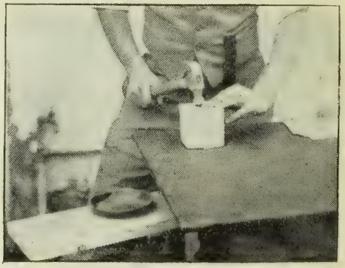

FIG. 70.— *The tack should be placed on the folded corner of the paper. A sharp tap with the hammer forces it through the paper against the head of the bolt in the block and causes the point of the tack to double up even with the head*

The severity of the operation of transplanting depends on the method that is used to remove the seedling from its position in the flat or bed.

If a large number of roots are taken, the severity of the operation will be lessened; but if only the taproot is retained in transplanting, the operation will be a great shock to the plant. It has been found that plants with fibrous roots, such as cabbages, tomatoes, lettuce, peppers, parsley, celery, onions, may be transplanted easily. The root surface of such plants is so well developed that the resultant plant is greatly benefited by the transplanting process. It is more difficult, on the other hand, to transplant such vegetables as peas, beans, corn, beets, turnips, radishes, melons, or squash, which have few fibrous roots, for most of these have a taproot or one or two main roots, and small laterals extending from them. When transplanted, the laterals are destroyed, and the shock to the main root is so severe that the plants are not able to survive. Such plants may be transplanted if the seeds are planted in pots, and the entire plant with root and adhering earth is transferred to the garden. Seed is sometimes planted on inverted sod and later transplanted to the garden. This method is especially successful with cucumbers.

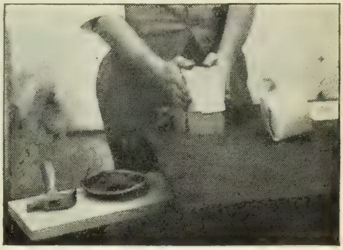

FIG. 71. — *The removal of the finished cup. The position of the hands should be noticed*

If the season is dry, transplanting is a difficult task, since evaporation is excessive and the roots do not develop. A normal amount of rainfall provides favorable conditions, promotes root growth, and encourages the progress of the plant.

Preparation of soil for transplanting

Preparation of the soil in the garden for transplanting is similar to the preparation required for sowing the seed out of doors. Fine texture and abundant moisture of soil are to be desired. All sticks, stones, and rubbish should be removed from the surface of the ground. It must be remembered that the greater the number of points of contact there is between the roots and the soil, the better the results will be. The maximum number can be secured only by the finest preparation of the soil.

The time for transplanting

The time for transplanting depends on two important factors, the time of the sowing of seed and the space available when the seedling is ready to transplant. According to the natural process of growth, the seedling should be removed from the seed bed after a definite length of time. If space is not available, transplanting has to be delayed. Many gardeners prefer to transplant on a rainy day, or on a cloudy day that precedes or follows rain.

Marking out

It is necessary to mark the ground before transplanting. The rows will be straighter, and the plants will have a definite space allotted to them, which affords the best opportunity for their fullest development. The process of marking has already been discussed. The garden line or the homemade marker may be used.

Transplanting by hand

The tools necessary for transplanting by hand are the common dibber, the trowel, and the spade. For hand work, they are the most desirable tools to use, since they may be thrust into the ground and worked forward and backward until an opening of the required size is made. The tool may then be thrust into the soil in front of the plant, and the soil may be pressed against its roots. The trowel should be used to dig a hole that will accommodate a potted plant with its ball of roots and soil. These tools should be handled in such a manner that the greatest possible number of points of contact will exist between the soil and the roots.

When plants are hand set, it may be necessary to follow transplanting by irrigation. This may be accomplished with the hose, a pail and a dipper, and a watering pot, or by the furrow system. Enough water should be applied so that it will penetrate to the roots. In the home garden, the task of watering may be lightened if the transplanted seedlings are shaded with newspapers.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE
NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
Entered as second-class matter at the post office at Ithaca, New York
W. A. STOCKING, JR., *Acting Director* A. R. MANN, *General Editor*
COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 58 FEBRUARY 15, 1914 **VEGETABLE-GARDENING SERIES No. 3**

PLANTING THE HOME VEGETABLE GARDEN

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully, and a personal reply will be made if information is requested.

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1. What site have you chosen for your garden?

2. Is your garden to be placed on a sandy or a clayey soil? Write details.

3. How do you prepare the soil for planting?

4. What is your method of sowing seeds? Have you tried soaking the seed? with what success?

5. Give your opinion of the man-power planters, such as the Planet Jr., the Iron Age, the Genung, the Columbia, and the Ames.

6. Do you start plants in the house? Give your methods.

7. Are you successful in transplanting? Give your methods.

8. Do you harden your plants before transplanting? How is this done?

Name..............................

Address............................

Date..............................

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COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 60 MARCH 15, 1914 **DAIRYING SERIES No. 4**

FARM BUTTER-MAKING

E. S. GUTHRIE

The making of butter does not begin with the churning process, but as soon as the milk leaves the cow's udder. It is impossible to make fancy butter from a poor raw product because of the presence of certain by-products of bacterial growth.

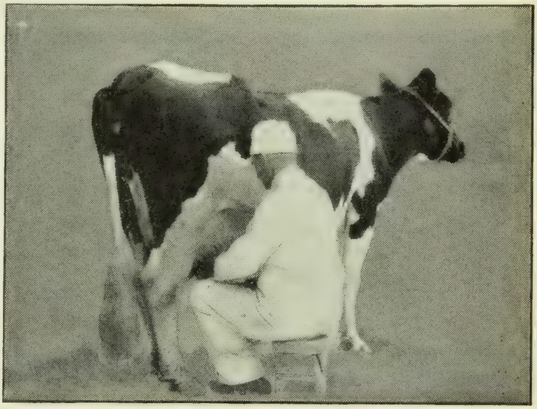

FIG. 72.—*Where butter-making begins*

CARE OF MILK AND CREAM

In the manufacture of butter microörganisms play such an important part that the question may well be asked, "What are bacteria, and under what conditions do they develop?" Bacteria are the lowest or the simplest forms of plant life. They do not fly or crawl as insects do, but they are transported by attaching themselves to objects that are moved in different ways from one position to another, as for example, to particles of dust, feed, bedding, hairs, flies, cobwebs, dairy utensils, and to the milker. Some of these objects may be carried by the wind, or by undue circulation of air. Some may drop from a nearby surface. There are many ways by which bacteria may be carried into milk and other dairy products. In dairy work it is important to eliminate these carriers. As will be seen later, this elimination may be effected by simple and inexpensive equipment and methods.

Concerning clean milk, Stocking * says:

> One thing which should be avoided is the brushing of the cows at, or just before, milking-time, since this stirs up more or less dust, a part of which is sure to fall into the milk during the milking and affect its quality. The effect of this process is shown by the accompanying figures:
>
> GERM CONTENT OF THE MILK DRAWN BEFORE AND AFTER BRUSHING THE COWS
>
> | | |
> |---|---|
> | Not brushed | 1,207 bacteria |
> | Brushed | 2,286 bacteria |
> | Increase due to brushing | 1,079 bacteria |
>
> If the brushing is done sufficiently long before the milking so that the dust will have a chance to settle, it will be beneficial, but it should not be done just at the time of milking.
>
> Another practice which is common with many dairymen is to feed the cows just before beginning to milk. Some men believe that cows will give more milk and milk more easily if they are eating while the milking is being done. I believe, however, there are few men who once get in the habit of milking when the cows are not eating, who will ever go back to the old practice. The cows will stand more quietly and the milking can be done much more comfortably if the cows are not trying to eat and at the same time watch the operations of the milker. The average cow does not have enough brain capacity to watch an operation at both ends at the same time. Feeding any dry feed at milking-time is sure to stir up a large amount of dust in the stable atmosphere, and this may seriously affect the quality of the milk, as indicated in the two accompanying charts:
>
> NUMBER OF BACTERIA PER CUBIC CENTIMETER OF MILK BEFORE AND AFTER FEEDING HAY AND GRAIN
>
> | | |
> |---|---|
> | Before feeding | 2,096 bacteria |
> | After feeding | 3,506 bacteria |
> | Increase caused by feeding | 1,410 bacteria |
>
> NUMBER OF BACTERIA PER CUBIC CENTIMETER OF MILK BEFORE AND AFTER FEEDING DRY CORN STOVER
>
> | | |
> |---|---|
> | Before feeding | 1,233 bacteria |
> | After feeding | 3,656 bacteria |
> | Increase caused by feeding | 2,423 bacteria |

What are some of the things which the farmer can do to improve the sanitary quality of his milk? Probably no one thing will have a more beneficial effect than the use of

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* Stocking, W. A. Problems of the milk producer. New York State Department of Agriculture. Circular No. 10.

a small-top milk pail. The accompanying chart shows the value of such a pail in three grades of stables:

SMALL-TOP PAILS

Stable	Pail	
		Good conditions
1	Open....	1,610 bacteria
	Covered..	280 = 17 per cent of 1,610
		Medium conditions
2	Open....	33,150 bacteria
	Covered..	1,740 = 5 per cent of 33,150
		Poor conditions
3	Open....	3,439,000 bacteria
	Covered..	103,600 = 3 per cent of 3,439,000

The first stable might be considered somewhat above the average in cleanliness, although it was an inexpensive basement stable and in no way would be considered an ideal sanitary stable. The two sets of figures show the results obtained with an ordinary open pail having a twelve-inch top and a pail of the same size carrying a cover with an opening five and one half inches in diameter.

The second stable might well represent an average dairy barn where no special care was taken to keep either the stable or the cows clean. Probably the results in this stable indicate fairly well what might be expected in the average dairy barn in New York State as a result of using a small-top pail.

The third barn was a very dirty one, as will be seen from the germ content of the milk drawn in the open pail. Yet even here the benefit resulting from this covered top is very marked. The use of such a pail involves practically no increased expense, and is not at all difficult to use, provided the proper style of cover is used. In selecting a pail with a small top, care should be taken to obtain one which can be used with ease and which is not difficult to clean.

Another inexpensive practice which will have very marked beneficial effects upon the milk is the use of a damp cloth for wiping the side, flank, and udder of the cow just before milking. This can be done by carrying a damp cloth and quickly going over these parts of the cow just before putting the pail in position for milking. This operation requires but a few seconds and will remove much of the loose dust that might otherwise fall into the milk pail during the process of milking. The accompanying chart shows the beneficial effect of this operation. It will be borne in mind that all the figures given in these charts are averages for a number of samples and not simply for individual samples of milk.

BACTERIA IN MILK BEFORE AND AFTER THE UDDER AND FLANK WERE WIPED WITH A DAMP CLOTH

Not wiped...............	7,058 bacteria
Wiped..................	716 bacteria
Decrease due to wiping....	6,342 bacteria

These are a few of the things which the milk-producer can do to improve the quality of his milk. None of them involves any appreciable cost in either equipment or labor. Even the small-top pail can be had at very little expense by getting a local tinner partially to cover the tops of your regular pails. Any dairyman by using a small-top pail and a damp cloth can produce clean milk in almost any stable which is fit for keeping dairy cows at all. As I said before, the methods used are far more important than the nature of the equipment. While it is desirable to have as good an equipment as possible because of the greater ease with which cows can be kept clean, this is not the most important factor in the production of clean milk. The methods used and the milker himself are the important factors in this work. It is easy for some people to be clean under almost any condition, while it seems to be practically impossible for other persons to be clean under even the best conditions. This difference in personal cleanliness oftentimes shows up among milkers in a very striking fashion, as may be seen by the accompanying chart:

BACTERIAL CONTENT OF MILK DRAWN BY DIFFERENT MILKERS IN THE SAME STABLE

Milker No. 1	2,455 bacteria
Milker No. 2	17,105 bacteria
Difference in favor of No. 1	14,650 bacteria

These men milked in the same stable under the same conditions, and yet one got over six times as many bacteria in his milk as the other. It seems to me the difference in germ content here must represent the difference in the natural cleanliness of the two men. One man did his milking with as little motion as possible, without rubbing against the cow or stirring up unnecessary dust, while the other brushed against the cow unnecessarily and dislodged enough dirt to produce the increased germ content.

In handling milk and cream, the dairyman should remember that proper care consists not only in the elimination of germ-carriers, but in the prevention of the growth of the bacteria that may get into such products, for it is impossible to eliminate all harmful organisms.

Under what conditions do these minute forms of plant life grow? Like the higher forms, the proper degree of temperature must be obtained. Also, they must have sufficient food and moisture. They are not dependent on sunlight, as other plants are; in fact, most of them are killed when exposed to the direct rays of the sun. These ideal conditions for the propagation of bacteria may exist in milk. In such cases it is necessary to change one or more of the conditions so that the microörganisms will not grow. The most feasible change is by lowering the temperature to such a degree that most of the organisms will not develop. Regarding temperatures, Professor Stocking says:*

After we have taken as much care in producing the milk as we can, there will still be some bacteria in it, and these should be prevented from growing by immediately cooling the milk to such a degree that their development will be checked. The more quickly milk can be cooled to a temperature of fifty degrees or lower, the slower will be the development of the bacteria. The effect of temperature upon milk is strikingly shown by the results obtained from a sample of milk which was thoroughly mixed and then divided into six equal parts. The six bottles were then placed in water at different temperatures for twelve hours, at which time the germ content of each lot was determined. The six bottles were then all placed together in a temperature of seventy degrees and allowed to remain until they curdled. As each sample curdled, the time was recorded. The difference in the germ content and the keeping time is the result of the difference in temperature for a period of twelve hours only, and shows what may easily happen in milk which is allowed to stand over night without thorough cooling.

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*Stocking, W. A. Problems of the milk producer. New York State Department of Agriculture. Circular No. 10.

Effect of Different Temperatures for Twelve Hours on the Growth of Bacteria and on the Keeping Quality of Milk

I
Kept at 45 degrees
Number of bacteria, 9,300
Curdled in 75 hours

II
Kept at 50 degrees
Number of bacteria, 18,000
Curdled in 72 hours

III
Kept at 55 degrees
Number of bacteria, 38,000
Curdled in 49 hours

IV
Kept at 60 degrees
Number of bacteria, 453,000
Curdled in 43 hours

V
Kept at 70 degrees
Number of bacteria, 8,800,000
Curdled in 32 hours

VI
Kept at 80 degrees
Number of bacteria, 55,300,000
Curdled in 28 hours

The principle of cooling applies in the same manner to cream as it does to milk.

LOCATION OF THE BUTTER ROOM

It is often difficult to determine the proper location of a room for making butter on the farm, because of the expense involved in construction. Probably the average herd on farms where butter is made, does not exceed ten cows. In New York State the average cow whose product goes into farm butter produces not over 150 pounds of butter-fat each year—at least less than one half pound daily. This would mean a churning of only ten pounds every alternate day. For this small amount of butter, or for even three or four times as much, only a small outlay for equipment can be made.

In Figs. 73, 74, 75, and 76 are shown different views of a small room which was provided in the cellar of the house on Elm Place, Fredonia, New York. Usually, the cellar is not considered to be the best place for a dairy room. It has certain advantages, however, if it is properly drained, is free from the usual odors of the cellar, and is well ventilated. First, it is near the kitchen where hot water may be obtained; secondly, the temperatures of a cellar are more easily regulated during the various seasons of the year.

It will be noticed that modern equipment has been obtained for use in this dairy of about twelve cows. The small-top milk pail and the Babcock test aid in the production of a high-class product and in the execution of business methods. The frame on which the cream and the butter sit may be dropped into the cooling pit. When the trapdoor is closed, fairly satisfactory temperatures are secured. The water is heated by gas. On farms where there is no gas, hot water can be conducted from the kitchen boiler.

CARE OF UTENSILS

If utensils are perfectly clean, they are clean both chemically and bacterially. The process of cleaning consists, first, in the removal of the dirt and, secondly, in the destruction of microörganisms.

In removing dirt, it is best to flush off most of the material with cold or lukewarm water. If the material to be rinsed off is largely fat, hot water is necessary. This first water should be discarded. The writer has seen dairymen empty the contents of a separator bowl into a dishpan and proceed to wash the separator in this sloppy water. As much judgment should be exercised in washing dishes as in doing other things.

After the easily-dislodged material has been removed, a washing solution should be prepared in order to cut the grease. The strength of this solution should depend on the nature of the material that is to be removed, and the amount of the solution will depend on the number and size of the utensils that there are to be cleaned. For washing a separator, about one half ounce of washing powder to one gallon of water is sufficient. This water should be as warm as the hand can stand. The tendency is to prepare too much solution and not to make it sufficiently strong.

The dirtiest utensils should be washed last. After all apparatus has been washed, the solution should be removed by rinsing. Very often it is necessary to use a brush to aid in the removal of the solution. This may be done in cold water or in the hot water that is used for scalding.

The next step is the cleansing of the apparatus bacterially. The utensils should be placed in water at about 180° F. and should be left at least one minute. The water may be heated by steam in a half-barrel, or it may be raised to the proper temperature in a container about the size of a wash boiler, which may be placed on the stove. Live steam is more efficient than hot water. If it is used, most of the utensils must be placed in a steam-tight chest. The high heat will accomplish two things and may aid in accomplishing a third. It kills nearly all of the bacteria, it heats the tinware sufficiently to dry it, and, in case of hot water, the washing solution may be rinsed off.

A mistake is often made in not using water that is sufficiently hot to kill the bacteria. A short experiment was made on the effect of warm water versus hot water for killing bacteria. Two buttermilk pails were cleaned in the same manner. One was held in a tub of water for one minute at a temperature of 130° F. The temperature was then raised to 180° F., and the other pail was submerged for one minute. A bacteriological study was made, and it was found that only a few organisms remained alive in the latter instance and that over two hundred times as many were left alive in the first pail. A temperature of 130° F., or a few degrees above, is not enough to destroy bacteria. The presence of steam, which may appear at this time, is not a certain indication of the scalding temperature.

After being scalded, the utensils should be placed upside down in a dustless and a flyless atmosphere.

The churn is likely to become sour if the microörganisms are not killed. Hot water is usually sufficient to kill them. Sometimes, however, it is necessary to allow a saturated solution of limewater to remain in the churn from one churning to another.

Brushes are more sanitary than cloths, for they are more easily cleaned. They are more efficient because it is possible to reach farther into the corners; and water of a higher temperature may be used for washing, for it is not necessary to have the hands in the wash water so much when a brush is used.

Drying cloths are unsanitary and unnecessary if the utensils have been properly scalded.

SEPARATION

The separator should be located in a convenient and a sanitary place. It should be maintained in proper running condition.

Gravity methods

The gravity methods of separation, such as the shallow pan, the deep-setting, and the water dilution, are used with profit on farms where only a small amount of butter is made. In fact, in the last two or three years, many of the separator companies have put on the market centrifugal separators sufficiently small for a dairy of only two or three cows. These separators are being sold at reasonable prices.

Gravity methods of separation have few advantages. They may be used only as the last resort. Their many disadvantages are outlined under " The modern method."

The modern method

The advantages of modern separation over the old gravity methods may be enumerated as follows:

1. Fewer utensils are used unless there are only one or two cows in the dairy.

2. The skimmed milk is in better condition for the stock in that it is fresh and warm.

3. Owing to the fact that the cream aggregates so small a quantity, it can be more carefully cooled and handled than the whole milk could be.

4. A cream richer in butter-fat can be skimmed. This is essential for good churning. Most of the gravity-skimmed cream is too poor in butter-fat.

5. Less butter-fat remains in the skimmed milk.

According to Hunziker in Bulletin 116 of the Indiana Agricultural Experiment Station, the butter-fat content of the skimmed milk from the various methods of separation is as follows:

Method	Percentage of fat
Modern	0.02
Deep-setting	0.17
Shallow pan	0.44
Water dilution	0.68

When the herd comprises ten cows each producing approximately 6000 pounds of milk per year, about $25 could be saved by using the modern separator instead of the deep-setting method.

Operation of the modern separator

When the machine is running properly, the important factors to be considered in the operation of a modern separator are speed, temperature of milk, inflow of milk, amount of bowl-flushing, test of whole milk, and cleanliness.

A machine will do its best work at the normal speed. The proper speed of each machine is indicated on the handle. The lower the speed is, the greater is the quantity of fat left in the skimmed milk and the lower is the percentage of butter-fat in the cream. A speed above the normal usually separates a cream of a higher percentage of fat, but the test of the skimmed milk is not affected.

In separating milk, a temperature of about 90° F. is commonly used. A lower temperature makes the cream too viscous. The lower the temperature, within certain limits — usually above 65° or 70° F. — the more butter-fat is lost in the skimmed milk, whereas the cream is richer in butter-fat.

Most separators will do good work when the inflow of milk is as great as the float will permit. When the flow of the whole milk into the bowl is small, the cream will test higher in butter-fat.

The amount of water or skimmed milk used for flushing out the bowl may affect the percentage of butter-fat in the cream more than may any other factor. Usually about two or three quarts of these liquids are necessary. If only a small amount of cream has been separated, however, two or three quarts of flushing water or skimmed milk dilutes the cream a great deal. If it were possible to have a definite amount of milk for each separation, by using a certain amount of flushing material with other conditions the same, the percentage of butter-fat in the cream should not vary widely. Under actual conditions it is impossible to have no variation in the amount of milk. For this reason, the percentage of dilution varies, and there is a consequent variation in the fat content of the cream.

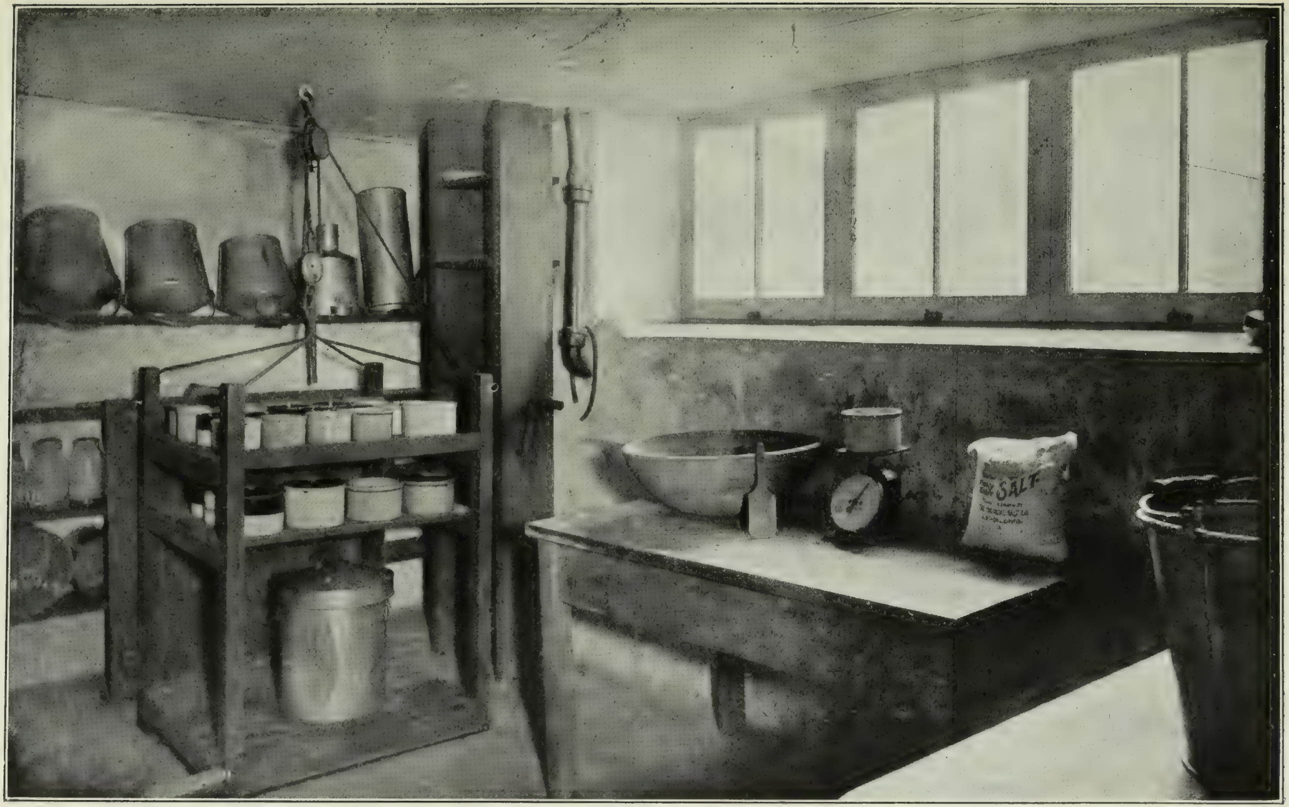

FIG. 73.—*A well-lighted butter-making room, located in the basement of the house on Elm Place, owned by L. D. Cowden. The frame on which the butter jars and the cream pail are set can be lowered into the cooling pit*

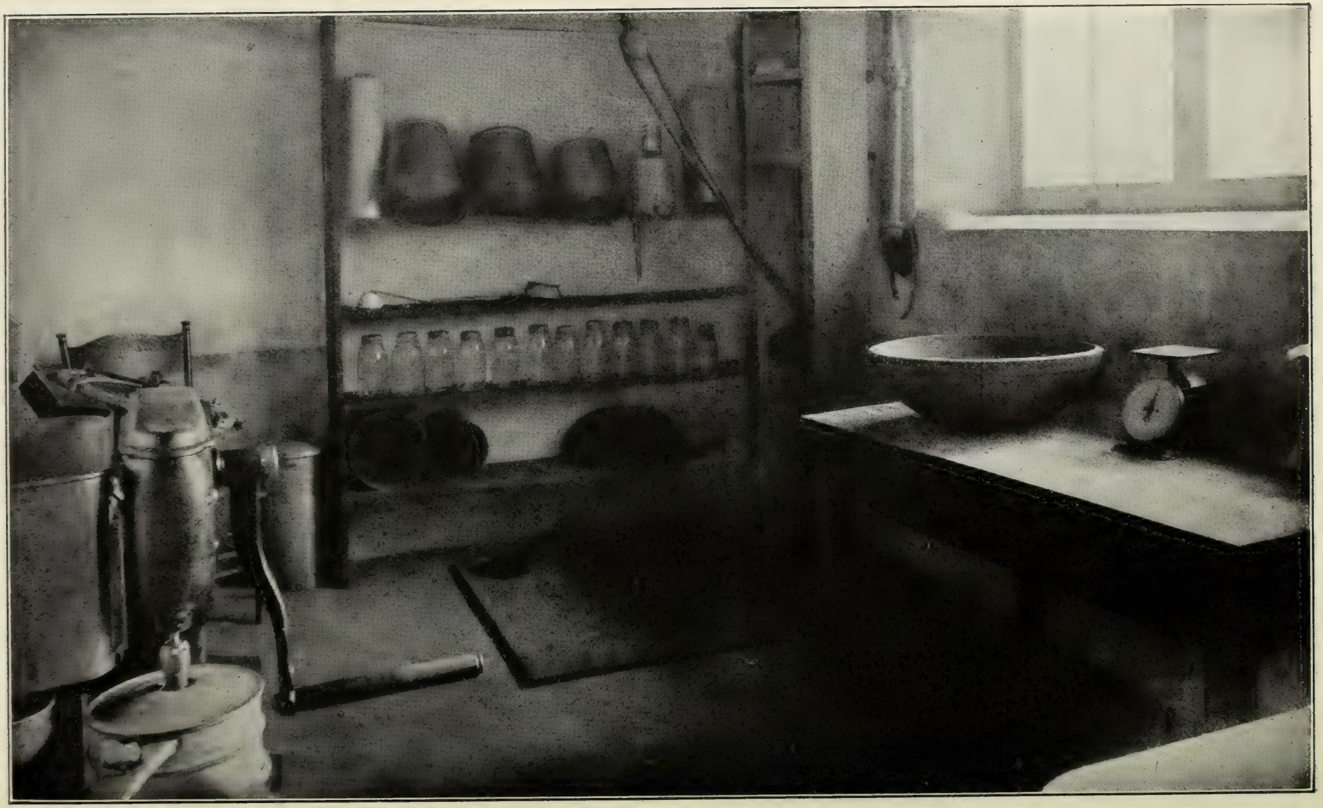

FIG. 74.— *The same room with the trapdoor closed over the cooling pit. The equipment is simple and substantial*

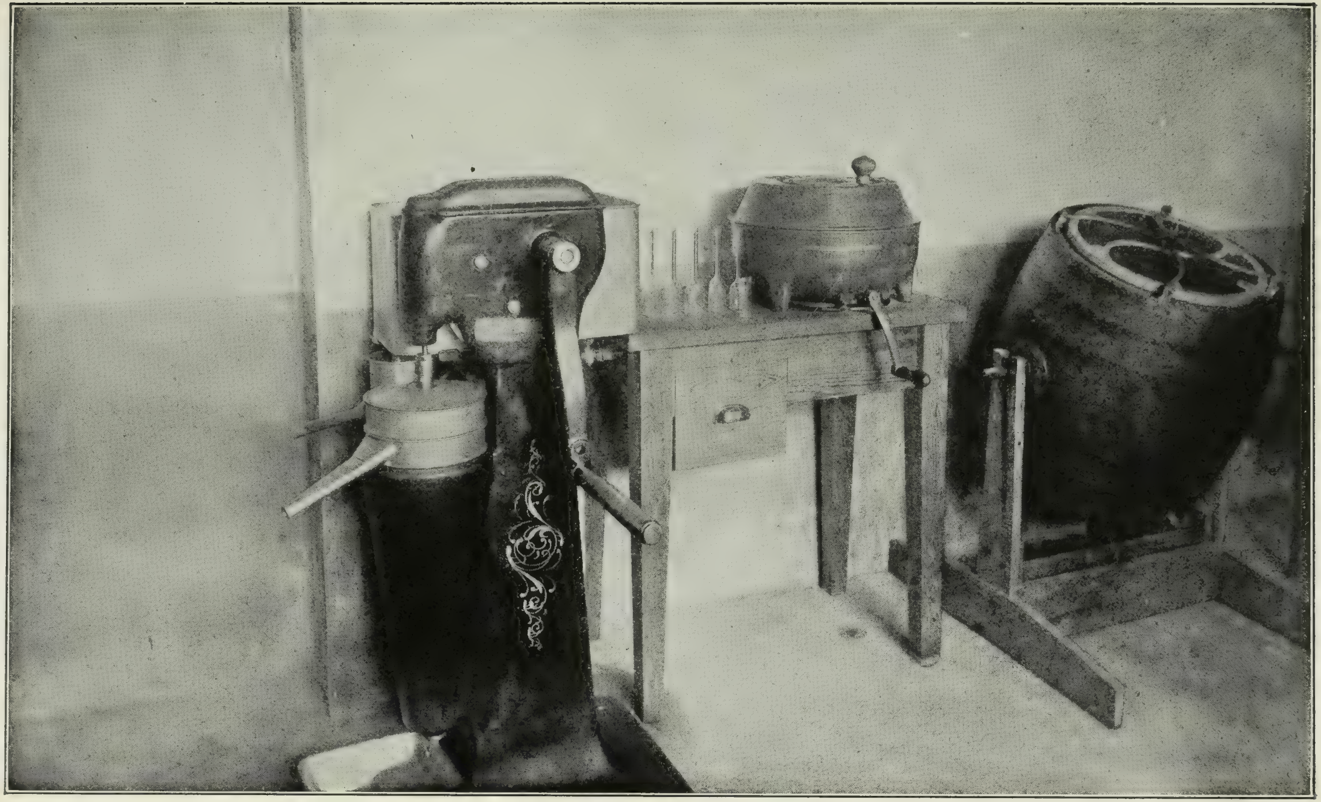

FIG. 75.— *Another view of the same room. The walls and floor are smooth, and thus are easily cleaned*

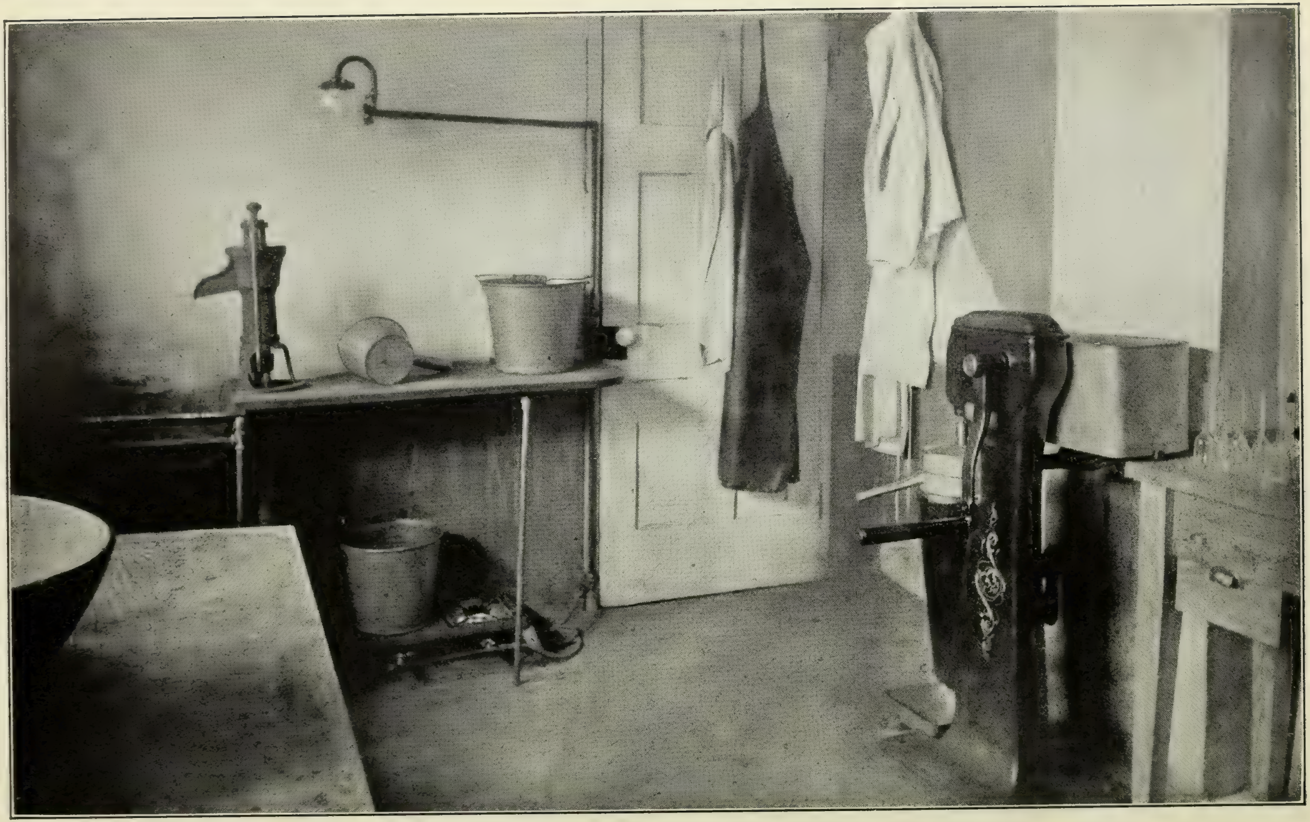

FIG. 76.— *View of the same room showing the water supply and sink. Notice the clean clothes that are used for dairy work only*

The question is often asked, "Which is the better flushing material, skimmed milk or water?" Ordinarily it is better to use warm skimmed milk that has just passed through the machine. It is convenient, and it will not dilute the final skimmed milk so much as water will. More important still is the fact that, if skimmed milk is used, bacteria of a more harmful nature than are already in the cream are not introduced. Water, although clear and fit for drinking purposes, may carry microörganisms that would cause undesirable flavors in cream and butter.

The percentage of fat in the cream is in direct proportion to the percentage of fat in the whole milk.

The effect of dirt in a bowl is to clog the small passages, and thus it is necessary from the standpoint of efficiency of separation to clean the machine after each run. From the standpoint of sanitation, the matter of washing the separator after each separation needs no comment; it is absolutely necessary.

CREAM-RIPENING

It is difficult to advise the farmer regarding the souring, or ripening, of cream because of varying conditions. It is a question whether or not the average farm butter-maker can afford to use starter, which is a culture of lactic-acid-producing organisms that should be used in creameries; for, in the first place, few farmers are trained to handle the propagation of these bacteria properly, and, in the second place, the amount of starter that he would use is so small that he could probably obtain better results by spending his time in being more careful in the care of the milk and the cream. For information on the propagation of starter, see Circular No. 13 of the Cornell University Agricultural Experiment Station.

Under ordinary conditions the cream should be cooled to 50° F., or to a still lower temperature, as soon as it is separated. On the second day it should be ripened by raising the temperature to 70° or 80° F. and maintaining that temperature until a mild acid flavor is developed. The cream may be held for several days if the flavor remains good; if it is likely to become strong, it should be churned before reaching this stage.

Sometimes a bitter flavor develops. In order to prevent it, the cream should be ripened as quickly as possible after separation. In this case the ripening process might be conducted as follows: Set the freshly separated cream at about 70° F. When the next separation is made, put the warm cream into the can with the first separation, which is partly soured, and stir thoroughly. Continue this process for two or three days. Care must be exercised in controlling the temperature so that the cream will not be overripened. On the second and third days, perhaps, the ripening temperature will have to be dropped to 60° or 65° F.

Another method would be to add a small amount of buttermilk to the first batch of cream, which would serve as a starter. The reason why this method should be used in case a bitter flavor develops is that the bitter flavor is produced by bacteria which grow in milk and cream at temperatures of 50° F. or below; the bacteria will not grow even at these favorable temperatures if the cream is sour.

CHURNING

Nearly all churns are made of wood, for wood is a good nonconductor of heat. Metal churns are more sanitary than wooden churns, but are impracticable, for the fat adheres to them; and it is more difficult to control temperatures in metal churns.

Important factors in the churning quality of cream

Temperature.— Temperature is the most important factor influencing the churning process. The butter-fat globules should be sufficiently warm to cohere, but on the other hand the temperature should not be so high as to cause greasy butter, increased loss of butter-fat in the buttermilk, or the incorporation of too much buttermilk in the butter. In the hand churn, with well-ripened cream testing 30 to 40 per cent butter-fat, the temperature should be 56° to 62° F. After the ripening process and several hours before the cream is placed in the churn, the temperature should be lowered to the proper degree for churning. The reason for this care in cooling the cream is that it requires some time for the fat to recrystalize, or harden.

The butter-maker should regulate the temperature, the richness of the cream, and all other factors, in order that the butter will not have a broken grain and be greasy, but will be firm and waxy. He must remember that the proper churning temperature is that at which the churning process will require 30 to 45 minutes when all of the other factors are normal.

Richness of cream.— It is easy to understand that rich cream, in which there is a comparatively small amount of serum, will churn more readily than cream containing a greater amount of serum, which interferes with the concussion of the fat globules. For easy churning the cream should contain 30 to 40 per cent of butter-fat. Thin cream is often the cause of difficult churning. Sometimes it is necessary to churn cream with a low percentage of butter-fat, but this is done at the expense of time or the quality of the butter, and often of both. If the cream is too rich in butter-fat, it will adhere to the sides of the churn. This may also cause difficult churning.

Ripeness of cream.— Ripe, or sour, cream is less viscous than sweet cream, and it therefore churns more easily.

Condition of butter-fat.— The kind of feed given the cows has a marked effect on the condition of the butter-fat. In winter, when the cows are on dry feed, usually the fat is harder than in summer. The condition of the butter-fat is also affected by the breed of the cow, her individuality, the stage of her lactation period, and perhaps a few other factors. Hard fat requires a few degrees higher temperature in churning than soft fat requires.

Size of butter-fat globules.— The size of the butter-fat globules has a marked effect on the churning quality of cream. The large fat globules come in contact with each other much more readily than the small ones do. The size of these small divisions of fat in milk and cream are probably affected by the same factors that control the condition of the butter-fat. Very often a "stripper's" cream is difficult to churn because the fat is hard and the globules are small.

Amount of cream in churn.— The churn should be one third to one half full. There must be enough cream to fall nicely, and yet not so much that concussion does not take place.

Speed of churn.— The greatest possible agitation is desirable. Therefore, the churn must be speeded carefully, not too slow nor too fast. Just before the cream breaks, it is very thick and it adheres to the walls of the churn. At this stage of the churning process the speed should be lessened.

Abnormal microörganisms.— Certain microörganisms, such as ropy milk bacteria and yeasts, prevent the cohesion of the fat globules. Difficult churning is the result.

Steps in the manufacture of butter

1. Have the temperature of the cream right (page 126).

2. Place in hot water all the woodenware (ladles, printer, and the like) that may come in contact with the butter.

3. Have the churn clean and so set that it will not turn over.

4. Pour the cream into the churn through a wire, hair, or perforated tin strainer. This operation should not be overlooked, especially if the cream is lumpy.

5. Add the color to the cream in the churn. Usually one to two ounces of color per one hundred pounds of butter-fat is sufficient. This may vary with different brands of color and market requirements. If the butter-maker forgets to put the color in the cream, it may be mixed in the dry salt and worked into the butter. Probably it will be necessary

in this case to overwork the butter somewhat in order to distribute the color and the salt properly.

6. After securely fastening the cover, give the churn eight or ten revolutions and then pull out the plug in order to let the gas escape. It is usually well to hold the hand over the hole in such a way as to prevent the cream from blowing over the room. Return the plug, and revolve the churn fifteen or twenty times more and again let out the gas. If the churn is not too full, usually two or three stops for this purpose are sufficient.

7. The churning process is nearing completion when the glass becomes clear. The particles of butter should be about the size of a pea or a kernel of corn, for the buttermilk drains off more readily when the granules are of this size than when they are very small. If churned too long, too much buttermilk is incorporated.

8. Drain off the buttermilk through a strainer.

9. In washing the butter, pour in just enough water to aid in draining off the buttermilk. Add about as much water as there was buttermilk drained off. The temperature should be about 54° or 58° F. If it is too high, the butter will be greasy. If it is too low, the butter will be too hard to work in the salt nicely. If the butter is hard, extra working is required and it is likely to be tallowy.

10. After washing, place the butter on the worker or in the bowl that has been thoroughly cooled and distribute the salt over it. If the salt is hard and dry, or cold, and dissolves slowly, it is well to place it in a vessel and just cover it with water at the same temperature as the wash water, or perhaps two or three degrees higher. After standing a few hours the salt will be softened and warmed and will dissolve in the butter much more quickly than when very dry or cold. The amount of salt will depend on the market. The average is one to one and one half ounces per pound of butter-fat.

11. The purpose of working butter is mainly to distribute the salt, and secondarily to compact the butter. Do not give the ladles a sliding motion over the butter as this will make it greasy. The working process may be done in a bowl, in the churn, or on a worker. Sometimes it is well to let the butter stand for the salt to dissolve before the working process is completed. If the butter has not been worked sufficiently, mottles may be found in it after it has been in cold storage for a day.

12. As soon as it is worked, the butter is ready to be packed. The packages should be clean and cool, and the butter should be packed firmly. If paper or wooden packages are used, particular precaution must be taken against mold. The kind of package must suit the market.

13. Butter absorbs taints very readily. It should not be kept in the

refrigerator or cellar with vegetables, meats, and the like, unless in an air-tight package. In the majority of places where butter is stored, a sufficiently low temperature is not maintained. A refrigerator with plenty of ice is the most satisfactory method of cooling, and, at the present prices of butter, it is the most desirable means of maintaining low temperatures.

MARKETING BUTTER AND ITS BY-PRODUCTS

The kind of market, the distance from market, the size of the herd, dairy equipment, and the like must be considered by all dairymen in determining an outlet for their dairy products. If one is to make butter, how shall one obtain the very best trade?

Above everything else the product must be uniformly good and it must have a neat appearance. If a special price is desired, the butter should be placed in one of the best stores and be kept in an ice box away from the flavors of groceries. Sometimes butter can be sold on a milk route, the milkman receiving a commission for selling it. Often, a dairyman with a herd of medium size is too far from market to retail whole milk daily. In such a case he might make and sell butter, buttermilk, and cottage cheese, and deliver such products only two or three times a week. He would then have the skimmed milk, and perhaps surplus buttermilk, for the stock.

For convenience not only to the consumer, but to the route man, packages of a uniform size should be used. One-pound prints are the best. (Some markets can be trained to take any good and convenient package.) The pound prints should be wrapped in parchment paper (8 x 11 inches). This parchment can be obtained for about $1 per 1000 sheets. The use of a paraffined-paper box or carton, just the right size for the print, is desirable, for it protects the butter from heat and dirt. Cartons and parchment can be purchased of paper or dairy supply concerns. The cartons cost about $3.50 for a single 1000. The package consisting of the parchment wrapper and carton in small quantities would cost about .45 of a cent per pound of butter. In larger quantities the cost would be less.

Buttermilk sells at ten to twenty cents per gallon. It can be delivered on the route in two-quart glass bottles. Cottage cheese in cubes of one quarter of a pound each, nicely wrapped in parchment, will sell for five cents.

In catering to a first-class trade, it is desirable that the route man be dressed neatly and that he shall not carry barn odors. It would be well for him to have a clean, washable suit to be worn only on the route. In winter he can wear an overcoat of the washable material over a heavy overcoat, or a jumper suit over his regular suit.

THE CORNELL READING-COURSE FOR THE FARM

The Cornell Reading-Course for the Farm aims to assist those who desire to read reliable agricultural literature. It provides an opportunity for those who are unable to leave their work to receive in their homes consecutive instruction on subjects of particular interest. The course is conducted by means of printed lessons dealing with practical agricultural problems. Certain lessons discuss fundamental principles which should be understood by those who wish to farm most successfully; others contain concrete suggestions or give detailed directions for the best practices. Below is given a list of available lessons showing the arrangement by series. The number of lessons available is increased by the publication of a lesson each month, which is added to the appropriate series. The new lessons are sent to readers as issued. Enrollment in the course is by series. Each lesson is accompanied by a discussion paper which contains questions on the important points in the lesson. If the discussion paper is returned it is read carefully, and a personal reply is made when information is requested. Another Reading-Course lesson in the same series is sent on the receipt of a discussion paper whether the questions are answered or not, as the return of a discussion paper indicates the reader's desire for further instruction. It is hoped that the discussion paper not only will assist the reader, but also will bring the College and the individual farmer into a more intimate relationship. The College appreciates any expression of opinion by readers, as the experience of those in touch with local conditions enables them to present a point of view which is of great value.

AVAILABLE READING-COURSE LESSONS FOR THE FARM, ARRANGED BY SERIES

Residents of New York State may register for one or more of the series mentioned below by addressing The Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, New York.

SERIES		LESSONS
The soil	2	The soil: its use and abuse
	42	Tilth and tillage of the soil
	50	Nature, effects, and maintenance of humus in the soil
Poultry	4	Incubation — Part I
	6	Incubation — Part II
	10	Feeding young chickens
Rural engineering	8	Knots, hitches, and splices

SERIES		LESSONS
Farm forestry	12	The improvement of the woodlot
	28	Recent New York State Laws giving relief from taxation on lands used for forestry purposes
	40	County, town, and village forests
The horse	14	Horse-breeding to increase the farm income
	46	Feeding and care of the horse
	56	Practical horse-breeding
Dairying	16	Practical dairy problems
	32	Composition of milk and some of its products
	54	The dairy herd
	60	Farm butter-making
Fruit-growing	18	The renewal of the neglected orchard
	22	The culture of the currant and the gooseberry
	36	Culture of red and black raspberries and of purple-cane varieties
	48	Culture of the cherry
	52	Culture of the blackberry (in press)
Farm crops	20	Alfalfa for New York
	24	The rotation of farm crops
Stock-feeding	26	Computing rations for farm animals
Vegetable-gardening	30	Hotbed construction and management
	34	Home-garden planning
	58	Planting the home vegetable garden
Plant-breeding	41	Improving plants by selection or breeding
	38	Principles and methods of plant-breeding
	44	Methods of breeding oats

The above list is correct to February 15, 1914. The demand may at any time exhaust the supply of particular numbers. Requests will be filled as long as the supply lasts.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE
NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY
Entered as second-class matter at the post office at Ithaca, New York
W. A. STOCKING, JR., *Acting Director* A. R. MANN, *General Editor*
COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 60 MARCH 15, 1914 DAIRYING SERIES No. 4

FARM BUTTER-MAKING

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully, and a personal reply will be made if information is requested.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT-GROWING, FARM CROPS, STOCK-FEEDING, VEGETABLE-GARDENING, PLANT-BREEDING. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. *Persons who wish to receive the new lessons in this series should therefore sign and return this discussion paper whether the questions are answered or not.* The Reading-Course will endeavor to aid in the solution of farm problems and in the organization of study clubs, and to give references for advanced study. *The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested in the course.*

1. Has it been your practice to prevent circulation of dust when milking?

2. Do you use a damp cloth for wiping the udder of the cow before milking?

3. Do you use a cleaning powder in your wash water?

4. Do you thoroughly cleanse the utensils in *hot* water or in live steam after washing? What should be the temperature if water is used?

5. Does your cream vary in its percentage of fat? If so, what do you think causes the variation?

6. What method of ripening cream do you use?

7. How long do you usually churn?

8. Have you had difficulty in churning? If so, what do you think is the cause?

9. Did you ever use limewater for cleansing the churn? If so, was it effectual?

10. What is your method of controlling temperatures, for holding (a) cream, (b) butter? Is this method satisfactory?

Name..

Address..

Date..

The Cornell Reading-Courses

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COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 62 APRIL 15, 1914 FARM FORESTRY SERIES No. 4

METHODS OF DETERMINING THE VALUE OF TIMBER IN THE FARM WOODLOT

JOHN BENTLEY, Jr.

Persons who have read the first number[1] of the Farm Forestry Series of Reading-Course lessons have learned something about the proper management of trees in the farm woodlot in order to obtain their best growth; also how to make cuttings in timber so as to improve the condition of the remaining trees. The object of all work in forestry is the production of wood and lumber for use. Since this product has a real value, the question may very properly arise: "How can I estimate the value of my timber?"

In many parts of the State it is not uncommon to hear of timber being sold by the piece or by the acre, without any reference whatever to the amount of lumber or cordwood there is in the woodlot, and regardless of the true value of the product in the market. What takes place usually is this: A portable sawmill outfit passes through the region; a woodlot owner who needs to raise a little ready money hears of it and offers his timber for sale, or perhaps the sawmill owner has noticed a good piece of timber and approaches the owner with an offer. The sawmill owner knows that the majority of farmers have no means of telling exactly what their timber is worth. As a result the timber is often sold for a sum of money much smaller than it is really worth simply because the owner of the woodlot is ignorant of timber values and of how such values are determined. In many cases timber has been sold for less than half of its true value. It is therefore worth while for the farmer to inquire into the matter of timber values, and before accepting any offer for the timber in his woodlot he should ask himself these questions: "Is the timber in my woodlot worth \$2 a thousand on the stump, or is it worth \$10 a thousand?" "How many thousand feet of lumber can a skillful sawyer obtain from my woodlot?" "How much does it cost him to cut the trees, haul the logs to his sawmill, and saw them into lumber?" "Am I getting all that I can get, or should get, for my timber?" A few farmers can answer these questions for themselves, or can seek advice from some one in the neighborhood who has had experience in buying and selling timber, and who knows timber values. But there are many persons in the State who desire definite knowledge concerning the way in which the value of standing timber is determined. It is the purpose of this paper to discuss ways and means of finding out, first, how much merchantable timber there is on a given piece of land; and secondly, how much that timber is worth in the market, under given conditions. The whole subject can be dealt with to the best advantage by a discussion of the following subjects:

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[1] Reading-Course Lesson for the Farm, Vol. I, No. 12, Farm Forestry Series No. 1, "The improvement of the woodlot."

- Units of measurement in common use
  - The board foot
  - The cord
  - Standards
  - The cubic foot
  - Poles, posts, railroad ties, and other units
- Reckoning the contents of logs in board feet
  - Log rules: their construction and application
  - Factors affecting the board-foot contents of logs
  - Relations between board measure and cubic measure
  - Relations between cordwood and cubic measure
- Scaling
- Methods of estimating the merchantable saw timber in a woodlot
  - The tree-to-tree count
  - Volume tables
  - Area methods
- Methods of estimating the cordwood in a woodlot
  - Cordwood tables
- How to determine the stumpage value of timber under different conditions
- Summary

UNITS OF MEASUREMENT IN COMMON USE

The board foot

Most lumber is sold by the thousand feet, board measure (M feet, B. M.), and the board foot is by far the commonest unit of measure in use. For example, we may learn by inquiring at the nearest lumberyard that hemlock is selling at "$22 per thousand," or that white pine is worth "$35 per thousand." The meaning in each case is that a thousand feet of lumber of that particular kind is worth the price stated. The price varies, of course, with the many grades of the lumber and with the supply and the demand. A board foot — one of the thousand thus spoken of — is a board one foot long, one foot wide, and an inch in thickness, or its equivalent. Theoretically it should be exactly of these dimensions, or their equivalent, and 12 board feet should constitute a cubic foot; but for several reasons the term "board foot" is sometimes rather loosely applied, and a solid cubic foot of timber never yields 12 board feet in inch boards.

Board-foot measure is applied to lumber other than inch boards; planks, scantling, dimension timbers, and other pieces more than an inch in thickness are also reckoned in board feet. Thus a plank 2 inches thick, 1 foot wide, and 12 feet long, contains 24 board feet; a "two-by-four" 12 feet long contains 8 board feet. The rule for finding the board-foot contents of any regular piece of sawed lumber may be stated as follows:

Multiply the width by the thickness of the board (or other piece) in inches, and multiply this product by the length in feet; divide the result by 12.

Sometimes planks and dimension timbers will be sawed slightly less than the full number of inches called for. Thus, on close measurement, a two-by-four may be found to measure only $1\frac{7}{8}$ x $3\frac{7}{8}$ inches, or the thickness of a plank that is supposed to be the full two inches may prove to be but $1\frac{7}{8}$ inch. This practice is employed by some sawmills, and the contents of the timbers is reckoned as if the full thickness were provided. Again, if inch boards are planed on one or both sides, or if flooring is tongued and grooved, the pieces will be slightly less than the full inch in thickness or slightly less than the specified width; but they are nevertheless reckoned as full size, because in the beginning a board of full size was used to produce the finished, planed board. These slight differences in actual thickness are understood by the purchaser, and there is no intention on the part of the manufacturer to defraud; it is simply customary to reckon in board feet, as if the material were the full size.

A special stick is sometimes used by lumber-inspectors, which shows at a glance the board-foot contents of a piece of lumber when width, thickness, and length are known. Such a stick simplifies the calculation of the amount of lumber in a number of boards when a large shipment of different sizes is being loaded.

The cord

Perhaps the next commonest measure for wood is the cord. Wood intended for fuel, for paper pulp, and the like, is usually measured by the cord, which is a convenient unit for sticks that are too small or too short to be scaled by the board foot. By a " cord " is understood a pile of wood cut into four-foot lengths and stacked so as to be four feet high and eight feet long. It may also be defined as 128 cubic feet of stacked wood. Unless otherwise specified, the full cord, as defined above, is understood. Sometimes wood only 18 or 24 inches in length or, indeed, any other odd length is stacked in piles 8 feet long and 4 feet high, and passes as a cord. It is generally understood, however, that such a pile is a " short cord," and the price of such wood is adjusted accordingly. The factors that influence the actual contents of a cord of wood are discussed on page 142.

Standards

In some parts of the State, notably in the Adirondack mountains, a log 13 feet long and 19 inches in diameter at the small end is spoken of as a " standard." The use of this unit of measurement dates back to the early days of lumbering in the Adirondack mountains; and to a limited extent its use still persists. Since a standard is roughly equivalent to 200 board feet, it is frequently reckoned as " 5 to the thousand." In New Hampshire and elsewhere, other standards are in occasional use.

The cubic foot

While common among foresters who are making a careful study of the volume growth of trees, the use of the cubic foot as a commercial unit is not common at the present time, although it may be adopted in the future as timber becomes scarcer and lumber more valuable. Even now, certain tropical woods of great value are bought and sold by the cubic foot. Long-continued usage has made the board foot and the cord the two commonest units, however, and for the reason that everybody is so familiar with them it will doubtless be a long time before the cubic foot will supplant them.

Poles, posts, railroad ties, and other units

Such pieces as poles, posts, and ties are sold by the separate piece. The piece of timber must generally satisfy certain dimensions as to length, width, thickness, diameter, or girth. When different sizes are recognized, the value of the piece is determined by size and quality.

Railroad ties, for example, may be standard gauge ties or narrow gauge ties or ties of special sizes, such as those used under switches or on bridges and trestles. It is also customary to recognize certain grades, or qualities, in ties. According to specifications furnished by the New York Central Railroad, ties are classified as follows:

All ties shall be 8 feet 6 inches (8′ 6″) long and sawed square at both ends. Not more than one inch variation in length, over or under the specified length, will be allowed.

Class A: Pole ties must be 7 inches thick and not less than 7 inches or more than 12 inches wide at any point on the face, and shall be hewed or sawed on two parallel sides. Only one tie shall be made from the section of a tree. Sawed ties must be square on four sides, 7 inches thick, and 9 inches wide.

Class A ties are reckoned as equivalent to 44 board feet each, or 23 to the thousand.

Class B: Ties may be hewed or sawed on four sides to size 6 x 9 inches. Two or more ties can be taken from one section of a tree.

Class C: Ties may be 6 inches thick with face not less than 6 inches at any point (not over 25 per cent shall have this minimum width) and may be hewed or sawed on two sides; or if hewed and sawed on four sides they may be 6 inches thick and not less than 8 inches wide on the face. This class includes also ties with slight splits and other minor defects that do not materially impair the usefulness of the ties, but exclude them from Class A and Class B inspection.

Ties must be piled in accordance with kind and class.

The prices paid in 1914 will be:

	Class A	Class B	Class C
All oaks, except red oak	70 cents each	63 cents	55 cents each
Red oak	55 cents each	45 cents	Not taken
Chestnut	65 cents each	60 cents	50 cents each

Poles may be of any specified length, usually in multiples of 5 feet, as 25, 30, 35, 40, 45, or 50; and they must be 7 inches in diameter at the top. They range in price from about $2 each for 25-foot poles to $9 each for 50-foot poles.

Posts are usually 7 feet long and of a specified diameter or girth at the small end. Values for posts depend on whether they are split or round, and whether of a durable species or a short-lived species. Definite values are hard to give. They may range from 10 to 50 cents each, according to size, species, and quality.

Pieces of small girth are frequently sold by the *linear foot*, or the running foot. This means that the value of the piece is determined by its length alone, no attention being paid to the diameter or the girth.

Other special units of measurement may be met with occasionally, but those named in the preceding paragraphs are the commonest. Since stumpage values are almost always reckoned in terms of board feet, the methods of determining the contents of logs in this unit will first be considered in some detail.

RECKONING THE CONTENTS OF LOGS IN BOARD FEET

Log rules: their construction and application

It is frequently necessary to have some means of determining about how much lumber can be obtained from a sound log when its length and diameter are known. In order to meet this demand, tables have been constructed, some from mathematical formulæ, others from drawn diagrams, and still others from actual mill tallies, which attempt to show the contents in board feet of sound logs of different lengths and diameters. Such tables are called log rules, log tables, or log scales, and may be found in books dealing with the subject of lumbering and in many books on forestry. There are many different log rules, some of which enjoy wide use, others being restricted to certain territories where they are known to give satisfactory results; still others are used only for certain local units of measurement. The practical value of any log rule depends not only on the accuracy and soundness of the principles by which it is con-

TABLE 1. BOARD-FOOT CONTENTS OF 10-FOOT, 12-FOOT, 14-FOOT, AND 16-FOOT LOGS, 6 to 40 INCHES IN DIAMETER, BY THE UNIVERSAL RULE AND THE SCRIBNER RULE.

Universal rule*					Scribner rule†				
	Length of log (feet)					Length of log (feet)			
	10	12	14	16		10	12	14	16
Diameter of log at small end (inches)	Board feet	Board feet	Board feet	Board feet	Diameter of log at small end (inches	Board feet	Board feet	Board feet	Board feet
6	9	11	12	14	6	10	12	14	18
7	14	17	20	22	7	16	18	24	28
8	20	24	28	32	8	20	24	28	32
9	27	33	38	44	9	25	30	35	40
10	36	43	50	57	10	31	40	45	50
11	45	54	63	72	11	40	50	55	65
12	55	66	78	89	12	49	59	69	79
13	67	80	94	107	13	61	73	85	97
14	79	95	111	127	14	71	86	100	114
15	93	111	130	148	15	88	107	125	142
16	107	129	150	172	16	100	119	139	159
17	123	148	172	197	17	115	139	162	185
18	140	168	196	223	18	133	160	187	213
19	157	189	220	252	19	150	180	210	240
20	176	211	246	282	20	175	210	245	280
21	196	235	274	313	21	190	228	266	304
22	217	260	303	347	22	209	251	292	334
23	238	286	334	382	23	235	283	330	377
24	261	314	366	419	24	252	303	353	404
25	286	343	400	457	25	287	344	401	459
26	311	373	435	497	26	313	375	439	500
27	336	404	471	538	27	343	411	479	548
28	364	437	509	582	28	363	436	509	582
29	392	470	548	627	29	381	457	533	609
30	421	505	590	674	30	410	493	575	657
31	452	542	632	722	31	443	532	622	710
32	483	579	676	772	32	460	552	644	736
33	515	618	721	824	33	490	588	686	784
34	549	658	768	878	34	500	600	700	800
35	583	700	816	932	35	547	657	766	876
36	619	742	866	990	36	577	692	807	923
37	655	786	917	1,048	37	643	772	901	1,029
38	693	831	970	1,108	38	667	801	934	1,068
39	731	878	1,024	1,170	39	700	840	980	1,120
40	771	925	1,079	1,234	40	752	903	1,053	1,204

* Printed with the permission of the author, Professor A. L. Daniels.
† Reprinted from the " Manual for Northern Woodsmen " by Austin Carey.

structed, but also on the skill and discretion of the man using it. Log rules are intended to show the probable contents of sound, straight logs when they are sawed by a sawyer who understands how to make the most of a given log. If defects are present in the log, the scaler must make certain discounts from the rule.

In practice, logs are scaled with the aid of a "scale stick," which is graduated to inches and has printed on it the values in board feet corresponding to the different sizes of logs (both by diameter and length). Thus, the board-foot contents of any given log may be read directly from the stick, which should be applied to an average diameter of the small end of the log, when the diameter and length are known. (For further details, see "Scaling," page 2059.) Scale sticks are manufactured for several of the common rules, so that each person may select the stick best adapted to his purposes and locality.

For convenience, two log rules are here given. One, the Scribner, is a very old rule that has been widely used in the northern States. It was constructed from diagrams allowing for a saw kerf of one fourth inch, which is a liberal allowance. The other rule, known as the "Universal," is based on a mathematical formula, and is printed here with the permission of its author, Professor A. L. Daniels, of the University of Vermont. It will be noticed that the values given in this rule increase regularly as the size of the log increases, while those in the Scribner rule are sometimes greater and sometimes smaller than are the corresponding values in the Universal rule. This is because the Scribner rule is not based on a mathematical formula.

If a comparison is made of several of the standard log rules in use, such as the Doyle, the Scribner, and the Maine, it will be found that the greatest relative differences occur in the small-sized logs. The Doyle rule,[2] for example, gives an extremely small scale for logs of small diameter, and a good sawyer can always saw out more board feet than this scale gives. For large logs, however, it gives too large a scale. The rule is really accurate only for logs of medium size, or for those of about 20 to 36 inches. The Maine rule gives best results when used with logs of short length. Many of the rules will be found to be adapted to the timber in certain parts of the country, while in other regions, where the trees attain different forms, they will give very poor results.

---

[2] The Doyle rule is very widely used, but it is inaccurate for logs of small diameters and for very large logs. It is based on the following formula:

$$\textit{Board feet} = \left(\frac{D-4}{4}\right)^2 \times L,$$

in which D equals the diameter of the small end in inches, and L equals the length in feet. The rule is inaccurate because it allows a uniform factor for slabs and saw kerf (the 4 inches which is deducted from the diameter) regardless of the size of the log. It is evident that this amount of loss differs with the size of the log, and it is a fact (not too widely known) that the Doyle rule gives values too small on logs up to about 20 inches. Since there is always a large proportion of small logs in any quantity of them, it follows that the mill cut overruns the scale by 10 to 20 per cent if the logs are sound.

It has been said that certain rules have been constructed from the results of actual work in the mills. In several instances in which a large number of logs have been followed through the mill, the product actually obtained has been found to agree very closely with the Universal log rule, and it is presented in the belief that its use will prove satisfactory.

Factors affecting the board-foot contents of logs

Besides the size of the logs, there are several other factors that materially affect the contents of logs in board feet. They are as follows:

The width of the saw used.— There are many different styles of saws used in the mills of to-day, such as circular, or rotary, saws, band saws, and gang saws. These vary considerably in form and thickness, and it is easily seen that the amount of wood taken out by the saw in passing through the log, technically known as " saw kerf," will affect directly the amount of the lumber that can be obtained. Thus, a band saw taking out a kerf only $\frac{1}{8}$ inch in thickness wastes only half as much as a rotary saw taking out a kerf of $\frac{1}{4}$ inch, and the final product may be 10 to 20 per cent greater in actual board feet.

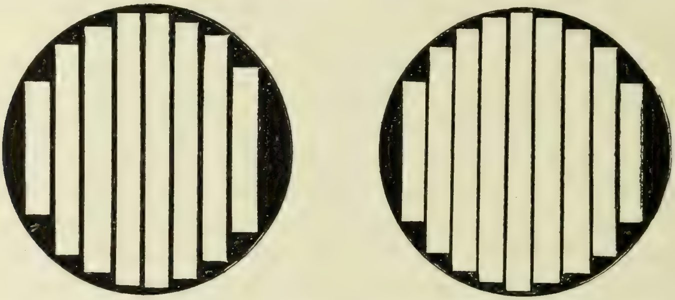

FIG. 77.— *Left-hand figure shows a $\frac{1}{4}$-inch saw kerf; the right-hand, a $\frac{1}{8}$-inch saw kerf*

In Fig. 77, the left-hand figure shows how eight boards 1 inch thick and not less than 6 inches wide may be obtained from a perfect log 12 inches in diameter, if a saw kerf of $\frac{1}{4}$ inch is taken out. Under these conditions a log 16 feet long of this diameter will yield 96 board feet. The right-hand figure shows how nine boards 1 inch thick and not less than 6 inches wide may be obtained from a log of the same size, if a saw kerf of only $\frac{1}{8}$ inch is taken out. Under these conditions the log will yield 108 board feet, or a gain of 12 per cent, due entirely to the saving in saw kerf. Since no logs are perfect, but exhibit some irregularities in form, it is seldom possible to obtain the full number of board feet as indicated above. Log rules, therefore, properly make allowances for these irregularities.

The width of the smallest board that can be considered merchantable.—If no boards less than 6 inches in width are considered as merchantable, it is apparent that much good lumber will be lost toward the outer part of the log next the slabs. This loss increases with small logs, as is shown in Fig. 78. From these drawings it will be seen that the product of a log is affected by the width of the board which may be considered merchantable. The saw kerf is $\frac{1}{4}$ inch in both cases, but in the left-hand figure only eight boards 1 inch thick can be obtained, if none less than 6 inches wide is considered merchantable; in the right-hand figure, nine boards 1 inch thick can be obtained if a board three inches wide is considered merchantable. In the first case, a log 16 feet long and 12 inches in diameter would yield 96 board feet; in the second, 104 board feet. Modern log rules allow for narrower boards than do the older log rules.

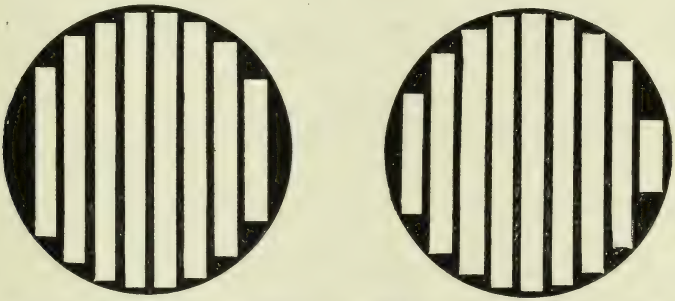

FIG. 78.—*Left-hand figure shows result when nothing less than a 6-inch board is considered merchantable; right-hand figure, when 3-inch boards are considered merchantable*

The straightness and soundness of the log.— If the log is crooked or if there is a defective spot in it, there is sure to be a loss in the number of board feet that can be produced from it. If the crook is slight, there may be a chance of obtaining short boards from the log, but even then there is certain to be some loss. In unsound logs the cause of the loss is very apparent.

The skill of the sawyer.— If the sawyer is careful to turn the log so as to take advantage of slight irregularities in form, which are common in almost every log, it is possible to make the log go farther and yield a greater number of board feet than if it is cut through and through without regard to its form and shape.

The efficiency of the machinery.— Well-kept and well-regulated machinery, sharp, carefully filed saws, attention to the little details of mill-adjustment, and like considerations will do much towards increasing the quantity and quality of the output. The efficiency of the machinery is a most important factor.

The thickness of the boards themselves.—If dimension stuff is being sawed from logs, there will be a larger scale than if inch-boards are sawed, because there is less loss in saw kerf.

It is apparent, therefore, that no one log rule can be expected to give uniformly accurate results under all conditions. Due allowance must be made for the factors just mentioned.

Relations between board measure and cubic measure

It is practically impossible to find any constant ratio between the cubic contents of logs and the number of board feet that they will yield. This ratio depends chiefly on the size of the logs, as will be seen by an inspection of the following table, which includes logs of only a few sizes for the purposes of illustration:

TABLE 2. THE CONTENTS OF LOGS IN CUBIC FEET AND BOARD FEET COMPARED
(A few representative sizes in the standard 16-foot log are chosen)

Diameter of 16-foot log (inches)	Contents in board feet, by the Universal rule	Contents in cubic feet	Ratio of board feet to cubic feet
6	14	3.14	4.5 : 1
12	89	12.56	7.0 : 1
18	223	28.27	7.9 : 1
24	419	50.27	8.3 : 1
30	674	78.54	8.6 : 1
36	990	113.10	8.7 : 1

When it is desirable to obtain an approximate equivalent between board feet and cubic feet, the figures given in the above table can be used as a guide. It must be remembered, however, that these values will not apply if a log rule other than the Universal is used.

Relations between cordwood and cubic measure

The actual number of cubic feet of wood in a cord of stacked wood varies from about 60 to 100, depending on the length of the sticks, the diameter of the sticks, the method of piling, whether the sticks are split or round, and whether they are green or dry. The straightness of the sticks also affects very strongly the amount of wood in a cord. In this respect, it is nearly always true that there will be less solid wood in a cord of hardwood sticks than in a cord of sticks from coniferous trees, as pines, spruces, and the like. A safe average factor to use in computing the actual number of cubic feet in a cord of wood is 70 per cent. This gives approximately 90 cubic feet for each cord of full size (8 x 4 x 4 feet).

SCALING

Scaling, or determining with the aid of the scale stick the contents in board feet of a given log, can be learned only through actual practice. It is almost impossible to give any hard and fast rules for scaling. The knowledge of how to allow for the defects that occur in nearly all logs is acquired by practice and observation; but although the art of scaling cannot be learned from books, the following points may prove helpful:

(*a*) Remember that the scale stick shows the contents of straight, sound logs, according to diameter and length; it is taken for granted that the sawyer is skillful enough to get the most out of a log. Even in sound, straight logs, loss may be caused by too thick slabbing, by cutting material too thick or too wide at the main saw, by poorly regulated machinery and dull saws, by waste in edging and trimming, and the like. Such loss is due to a lack of skill on the part of the sawyer and poor workmanship on the part of other operators, for which the scaler is not to blame.

(*b*) For certain visible defects, which are here explained, allowances can be made by the scaler. The more common terms used in defining defects are as follows:

> *Checks.* These are cracks, or splits, or seams, running lengthwise which are developed in the course of the seasoning of the log.
>
> *Dote.* This is the general term used by lumbermen to denote decay or rot in timber. The condition may be spoken of as " dote," or the part of the log decayed may be said to be " doty." Another term meaning the same is " dozy."
>
> *Cat-face.* This term is applied to partly healed scars on the stem of a tree caused by fire or mechanical injury. As a rule, cat-faces do not cover a very large part of the tree and do not constitute a serious defect unless they have caused rot to develop.
>
> *Shake* is defined as a crack in timber, due to the action of frost or wind, which usually results in the separation of the annual rings of growth, so that the continuity of the timber is broken. When " shaky " logs are sawed, the lumber resulting from them appears split and cracked. If the cracks follow the annual rings all the way around the tree, the defect is known as circular shake, and it results in a very large loss in the lumber.

The following suggestions, summarized from " The National Forest Manual " of the U. S. Department of Agriculture, may also be of some assistance:

Among the points which must be considered are the size and shape of the logs, the quality as affected by various kinds of defects, the size and location of the defect, and the requirements and limitations of markets. . . .

Measurement of diameters

All diameters will be measured inside the bark at the top end of the log. If logs are not round, scalers will average the greatest diameter inside the bark at the top end of the log with the diameter at right angles to this. The necessary reduction in diameter will be made for swelling at the scaling end of a log when no lumber can be produced from it.

Defects in logs

The following defects are most common:

Uniform center or circular rot, circular shake, pin dote, ground or stump rot, cat-face, dote at side of log extending to the bark, burns or defect caused by lightning extending along side of log, defect caused by lightning extending along the log in spiral form, punky or soft sap, deep checks or seams, dote appearing in knots, curve, or sweep, crooks, crotches, and blue sap.

Merchantable material

In general, a log containing sufficient sound material to saw out salable lumber equal to one third of its contents as given by the scale rule is termed " merchantable." This will be varied in accordance with the character of the timber and local market conditions. The term " sound material " is here used to signify such material as will produce lumber . . . commonly merchantable in the markets supplied.

Center or circular rot

For loss caused by uniform circular rot, the following rules are given:

For uniform defect 3 inches or less in diameter deduct 10 feet b. m. in logs up to 16 feet in length.

For defect 4 to 6 inches in diameter add 3 inches to actual diameter of rot, and deduct from the full scale of the log an amount equal to the contents of a log of the resultant diameter.

For defect 7 to 12 inches in diameter add 4 inches to diameter of rot and deduct an amount equal to the contents of a log of the resultant diameter from full scale of log.

In measuring the diameter of this type of rot the scaler should measure it at the end of the log showing the greatest area of defect, since the saw cuts in straight, parallel lines.

Shake

Circular shake may, in general, be allowed for as in center rot.

Dote

If the visible area affected by pin dote amounts to 4 inches in diameter, or more, it should be allowed for as in circular rot.

Cat-face

Cat-face may be allowed for in the following manner: Consider what proportion of the length of the log is affected; find the contents of this section on a scale stick, then determine the proportion of the section that will be lost in sawing, and deduct this amount.

Side defects

The percentage of loss caused by defects located at the side of a log is much less than when they occur near the center, since in the former case much of the defect will come out in slabbing. This is especially true of the butt of the first log where the flare or swell is considerable at the point of cutting.

Since they do not usually run deep and can be mostly removed in slabbing, defects caused by lightning extending spirally along a log do not affect the scale.

Spiral checks

Where deep spiral checks are found, the scaler will measure the diameter of the portion of the log included within the largest circle that can be described on a cross section without being materially affected by the checks, and class as defective all that part of the log outside the area defined by the circle.

Unsound sap

Where a shell of unsound sap occurs, only the sound heartwood will be measured.

Unsound knots

Where dote appears in the knots, it indicates that the area of rot increases in the portion of the log near the knots, and deductions should be from 10 to 50 per cent greater than when it appears at the ends alone.

Curve or sweep

The percentage of a log affected by sweep or curve varies according to the diameter of the log. An amount of curve that might cull a very small log would not necessarily cause the rejection of a larger log. The scaler should, when possible, sight along curved logs, noting where the saw would square the log, sufficiently to enable boards to be cut on both sides affected by the curve, thus determining the amount of loss caused by the sweep. It should be remembered that boards sawed near the slab are always narrower and contain fewer board feet than those sawed from the balance of the log.

METHODS OF ESTIMATING THE MERCHANTABLE SAW TIMBER IN A WOODLOT

In all cases when standing timber is bought or sold, it is desirable to have some means of telling approximately the amount of merchantable timber that can be obtained from the trees on a given tract of land. It is necessary to know the amount of timber in order to determine the value of the timber, which may be reckoned according to the thousand feet (M feet) board measure (B. M.), or the cord. The value of standing timber is frequently spoken of as *stumpage value.* The term means the value of the timber on the stump, that is, of standing timber. The work of thus determining the amount of lumber or other manufactured wood product that a given body of standing timber will yield when cut is called *timber-estimating*. It is also spoken of as *timber-cruising*. It consists of reckoning, either by means of some mathematical calculation or by the aid of past experience in judging timber, the amount of merchantable timber that exists on a particular piece of land.

Years ago, when timber was plentiful and the value of lumber was comparatively low, timber-cruisers would often guess at the amount of lumber that could be produced from a specified piece of land, arriving at their estimate by a process in which arithmetic played a very small part and practical experience a very large part. They had seen many bodies of timber cut; they knew how many acres were cut over and they knew how many logs were taken out; they knew how much lumber the mill had been able to produce from those logs. This experience gave them some idea as to how the timber in that part of the country might be expected to run. They also knew how much to allow for in the way of damage, defect, and unmerchantable material, so that their results were fairly accurate. They usually erred on the safe side, and estimated low rather than high. The method was good when stumpage values were very low; but with the increasing scarcity of timber and the rising value of lumber it has become necessary to have something more reliable than a mere guess, for a large amount of money is often at stake. Modern sawmills are expensive to set up and maintain, and modern methods of logging employ many men and costly equipment; it is therefore necessary to calculate rather closely on stumpage values and the cost of operations before venturing into the lumber business. Lumbermen want to know within about ten per cent the amount of lumber that their timber lands will yield when cut.

Although the amount of money involved is not large, it is just as important that the farmer who owns a woodlot of 5, 50, or 100 acres shall be able to tell within ten or fifteen per cent what his timber will yield. Even if he does not intend to sell his timber, he should know how much there is of it in order to avoid overcutting and mismanagement, which in the absence of definite figures are almost sure to follow, with a consequent depreciation in the value of the woodlot.

If any degree of accuracy is to be obtained in making estimates of standing timber, at least two figures are required: first, the average stand to the acre (or the stand of an average acre), and secondly, the number of acres in the tract under consideration. The only exception to this rule would be in the case of a very small woodlot in which a tree-to-tree count including every tree might be possible. In this case the area of the woodlot would not be required, but the estimate would be based on the count. If the number of acres in the woodlot and the stand on an average acre are known, the contents of the whole stand may be reckoned. Then, if necessary, certain allowances may be made for diseased, defective, or unmerchantable timber. Allowances of this kind can usually be made to best advantage when they are based on observations made at the sawmill, where logs can be watched in order to determine how they saw out, that is, to see what proportion of the lumber from the logs is unmerchantable.

Two methods of timber-estimating will be described: The first is based on the principle of a tree-to-tree count and is intended either for use on small areas only, where every tree can be counted, or for single trees. The second method is intended for larger areas, where only a small percentage of the trees can be counted.

The tree-to-tree count

Naturally, this method is the most accurate of all, for each tree is inspected and the contents is estimated separately. It thus becomes possible to allow for the irregularities of form and the varying degrees of taper that are exhibited by all trees, especially the hardwoods. In applying this method, one should first determine the breast-height diameter[3] of the tree to be estimated, and tally this in the column marked "Trees," as shown below in the sample tally sheet, Table 3. If possible this breast-height diameter should be measured accurately with a pair of tree calipers[4] (Fig. 79), because with a knowledge of the exact diameter at breast height it becomes much easier to judge the top-diameters of the logs above. If calipers are not convenient, a circumference tape may be used or the diameter may be judged by the eye. To do this accurately, however, requires considerable skill and practice. If an ordinary tapeline, graduated to inches, is used in getting the circumference, the measurement may be reduced to diameter by multiplying by $\frac{7}{22}$.

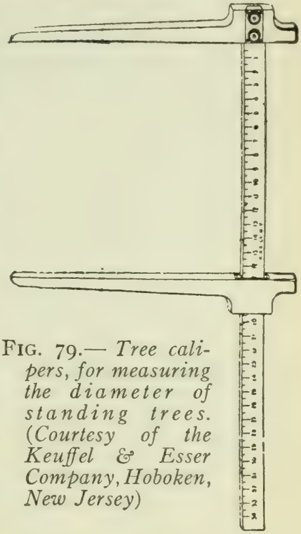

FIG. 79.— *Tree calipers, for measuring the diameter of standing trees. (Courtesy of the Keuffel & Esser Company, Hoboken, New Jersey)*

TABLE 3. SAMPLE TALLY SHEET FOR TIMBER ESTIMATES

Plot No........................ Locality..........................

Date................................. ....

(16-foot logs)

Diameter breast-high (inches)	Pine		Oak		Maple		Hemlock		Total		
	Trees	Logs	Trees	Logs	Trees	Logs	Trees	Logs	Logs	Scale	Board feet
6.............		.		.		.		: :	7	14	98
7.............		.		.				: :	6	22	132
8.............		. .		.		.		.	5	32	160
9.............		. .		. .		.		.	6	44	264
10.............		. .		. .			.	. .	6	57	342
11.............		. .		.			.	. .	5	72	360
12.............		.	.	.		. .	.	. .	6	89	534
13.............	.	.		.				. .	4	107	428
14.............		. .	.	.		.		:.	7	127	889
15.............		. .		. .	.		.	.	5	148	740
16.............	.					. .			2	172	344
17.............	.		.	.			. .	.	2	197	394
18.............	.	.		.			.	.	3	223	669
19.............					.	.			1	252	252
20.............	.		.					.	1	282	282
21.............							.				
22.............			.		.		.				
Totals......	5	17	5	15	3	9	9	25	66	....	5,888

The form of tally sheet here shown is convenient for recording trees and logs on a small plot. In such a tally sheet the first column, designated "Diameter," should contain numbers from 6 up to the diameter of the largest trees to be found in the woodlot. To the right of this column are columns for each of the species of trees that are to be estimated. These columns in turn are subdivided into two, the first for trees and the second for logs. The separate trees are tallied by breast-height diameter, and the several logs by diameter inside bark at the upper end. Thus, the first tree inspected on a plot might have been a pine whose diameter was 20 inches. According to the system of tallying used[5] a dot would be placed in the column marked "Trees" under "Pine," and opposite the 20 in the inches column. Then if this tree contained four merchantable logs whose top diameters were 16, 13, 11, and 8 inches, respectively, a dot would be placed in the column marked "Logs" opposite the corresponding diameters, 16, 13, 11, and 8. This process is repeated for every tree on the plot. After all the trees and logs are tallied, the totals may be read from the sheet. The logs are totaled in the column marked "Logs" under "Total," and the scale of a single log of that size is indicated in the column under "Scale." (This value is taken from the Universal log rule, page 2054.) The product of the number of logs by the scale of each one is indicated for each diameter in the column marked "Board feet." The sum of all the values in this column gives the total number of board feet on the plot, which is the object of the whole operation.

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[3] The diameter of standing trees is measured at a point 4 feet 6 inches from the ground, a distance designated as "breast height." The use of this standard height is to be preferred to the stump height, which is too variable.

[4] Tree calipers, instruments for measuring the diameter of standing trees, may be purchased from Keuffel & Esser Company, Hoboken, New Jersey, at a cost of $4.50 each for the 36-inch size.

Having obtained and recorded the breast-height diameter of a tree, the estimator next looks up the trunk of the tree, mentally divides the stem into logs of standard length, and decides just how many logs the tree will yield when cut. The work of estimating logs in the tree and the calculations made later will be easier if only one standard log-length is used. Thus, 16-foot logs are very common, and many estimators have adopted this length as their standard in estimating. In order to accommodate this length to trees that may have more or less than an even number of 16-foot logs, some estimators recognize half-logs, that is, 8-foot lengths, in their work. Any standard length may be chosen, of course, but the use of two or more standard lengths complicates both the tallying of the logs and the scaling of them later.

If the trunk of the tree that is being judged is straight and clear, with an even taper, the work of estimating the number of logs and their respective sizes will be a simple process; but if the trunk is irregular, or forked, or shows an excessive taper, the task will be more difficult. It is precisely at this point, however, that the accuracy of the method becomes apparent, because proper allowance can be made for such defects as crook, forks, or excessive taper. The next step to be taken is to decide at what points on the stem of the tree the tops of the successive logs will come, and to judge the diameter of the stem at these points. Allowances must be made for bark, and in each case the diameter of the several logs, inside the bark at the top end, is recorded in the column marked "Logs" on the tally sheet. Estimating the top diameters of logs in the tree is not easy

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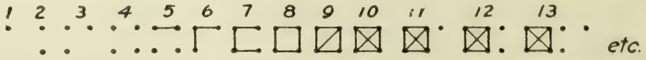
[5] The system of tallying used is called the "dot-and-dash" system. The following symbols show the values corresponding to them:



This method is economical of space and time, and, by its use, it is possible to record a large number of trees on a single sheet. Being arranged in blocks of ten, the tally is quickly and easily read.

to do, first, because trees do not taper uniformly and, secondly, because the thickness of the bark varies considerably not only with the species of tree but also with the size, the age, and the height of the tree and the locality in which it is growing. With the help of the suggestions in the next paragraph and a little practice, however, the timber-estimator will rapidly gain confidence. If one has an opportunity to observe the taper of logs and the thickness of bark on logs as they are cut in the woods or decked at the mill, it will not take long to acquire considerable skill in estimating the size of logs in the tree. This method of work is so much more likely to be accurate than any other that it is recommended here as the most practicable method for owners of woodlots to follow.

Most trees grown in the forest where they attain good form will taper 2 to 4 inches for every 16 feet in height. The taper in tall trees is less marked than it is in short trees that break up into branches at a relatively low point on the stem. The first, or butt, log and the last, or top, log will frequently show more taper than do the intermediate logs of a tree. Measurements on a large number of white pines show the following average taper for trees yielding four 16-foot logs:

	Taper
From diameter breast-high to top of first log	2 to 2½ inches
From top of first to top of second log	1½ to 2½ inches
From top of second to top of third log	2 to 3 inches
From top of third to top of fourth log	3½ to 4 inches

Each species of tree has its own characteristic form and taper, which must be observed and studied before great accuracy can be expected in judging tapers. The hardwoods are more irregular in taper than are the coniferous trees (pines, spruces, firs, and hemlocks).

The thickness of the bark is also a variable quantity. It depends not only on the kind of tree but also on the diameter of the tree at different ages and heights. Since it is necessary to make due allowances for the thickness of the bark in judging logs, the following table (Table 4) has been prepared. This table shows, for different species of trees, the approximate allowance that must be made for bark at different heights.

With the trees recorded by breast-height diameter and the logs recorded by length and top diameter inside bark, as shown on the sample tally sheet, Table 3, it is now possible to apply any desired log rule and scale the logs on paper. Thus, it was found that there were ten 16-foot logs of 8-inch diameter scaling 32 board feet each by the Universal rule, or a total of 320 board feet. Of the 9-inch logs, there were eight scaling 44 board feet each, or a total of 352 board feet. Each diameter class is calculated separately, and the total for that size is entered in the last column of the tally sheet. By adding all the values in this column, the total estimate for the trees of all sizes is found. The reason for recording the logs and the trees separately and keeping the number of trees by their breast-height diameter is to determine on how many trees the estimate is based. After a few reliable estimates have been obtained, other estimates in the same region may be checked by making comparisons of the number of trees.

TABLE 4. AMOUNT IN INCHES THAT MUST BE DEDUCTED FROM TOP DIAMETER OF LOGS OUTSIDE BARK, IN ORDER TO OBTAIN DIAMETERS INSIDE BARK

Size of 16-foot logs	Trees with thick bark (A)	Trees with thin bark (B)
On logs 24 inches and over	Deduct 3 inches	Deduct 1 to 2 inches
On logs 12 to 24 inches	Deduct 2 inches	Deduct 1 inch
On logs 6 to 12 inches	Deduct 1 inch	Deduct 1 inch*

(A) Trees with thick bark: oaks (especially chestnut oak and black oak), pitch pine, chestnut, walnut, butternut, ash, tulip poplar, cottonwood, locust, and hemlock.
(B) Trees with thin or medium bark: white pine, spruce, balsam fir, beech, hard maple, soft maple, birches, hickories, sycamore, cherry, basswood (except in old trees).

* Fractions of inches are not considered in scaling, and it is therefore useless to make smaller deductions.

As an aid in determining how many logs of standard length may be cut from a certain tree, it is well to measure the height of a few trees until the eye becomes accustomed to judging heights accurately. Methods of measuring the height of a standing tree are described on page 98 of the "Woodsman's Handbook,"[6] Bulletin 36 of the Forest Service, U. S. Department of Agriculture. The simplest of these methods is to compare the shadow of the tree with the shadow of a pole of known length, set perpendicular to the earth. Multiply the length of the shadow of the tree by the length of the pole, and divide the product by the length of the shadow of the pole. The result will give the height of the tree.

An instrument called a hypsometer, for the purpose of determining the height of trees, is made in a simple form as is shown in the accompanying illustration (Fig. 80). In order to use this instrument the operator should stand at a known distance from the base of the tree, and sighting in turn at the top and at the bottom of the tree he should observe the readings, as shown by the little pendulum. The readings are graded so as to give percentages of the base line. For example, a man standing 100 feet from the base of a tree sights to the top of the tree; the pendulum swings to 75. This indicates that the top of the tree is 75 per cent of the base line, or 75 feet above the level of the eye. When he sights to the bottom of the tree, the pendulum swings to 5 on the opposite side of the zero mark. This indicates that the foot of the tree is 5 per cent of the base line, or 5 feet below the level of the eye. Adding these two readings, we obtain 80 as the total height of the tree. Any convenient distance may be chosen as a base line, and the principle is always the same — the sum of the readings represents the height of the tree in terms of a percentage of the base line.

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[6] This publication may be purchased from the Superintendent of Documents, Government Printing Office, Washington, D. C., for twenty-five cents. (Do not send stamps, for they will not be accepted.)

The best results are obtained when a base line of at least 100 feet is used. Full directions for using this instrument accompany it.

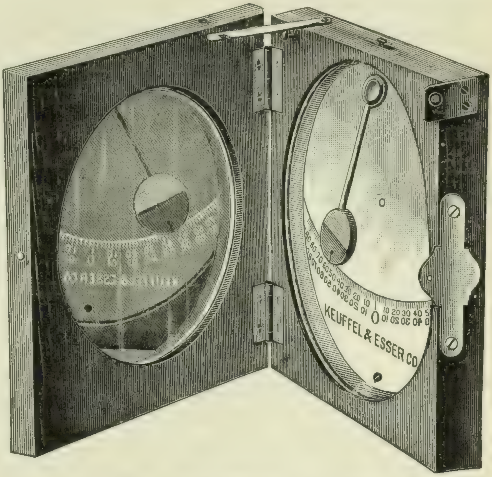

FIG. 80.— *Box hypsometer, an instrument for determining the heights of standing trees. (Courtesy of the Keuffel & Esser Company, Hoboken, New Jersey)*

Volume tables

Instead of going through the process of mentally dividing trees into logs and scaling them on paper, as described in the tree-to-tree count, it is sometimes possible, by the help of reliable volume tables, to shorten the work and obtain the estimate by measuring only the diameters and the heights of the trees. The contents in board feet can then be read directly from volume tables. Volume tables are, therefore, tables from which the board-foot contents of a tree can be determined when the breast-height diameter and the height are known. They are constructed from measurements taken on a large number of felled trees. These measurements are then averaged and compiled in the form of a table, a sample of which is shown on page 152. Since the values given in volume tables are the results of averages, it follows that they give satisfactory results only when applied to a large number of trees, or when the trees are known to be of average form. Furthermore, a volume table should be used only in a locality where conditions are practically the same as those that prevailed in the locality where the volume table was constructed. That is, it would not be wise to use for white oak in western New York a table which had been constructed from measurements of white oak grown in North Carolina. Neither would it be wise to use for white oak grown in a rich, moist bottom land, a table that had been constructed from the measurements of trees grown on a dry, rocky hillside, even though not far distant. The conditions, both general and local, must be similar.

Therefore, while the use of volume tables is often very convenient and time-saving, it is safe to use them only when a large number of trees is being estimated and when a table can be found that is known to have been constructed from trees growing under the same general conditions which prevail in the locality in question. Unfortunately there are but few reliable volume tables in existence at the present time. The " Woodsman's Handbook " contains a few tables that are fairly reliable. One of these is shown below in order that the form of a volume table may be understood by the reader. When good volume tables are available, this method will be a safe one to use.

TABLE 5. SAMPLE VOLUME TABLE FOR WHITE PINE IN NEW HAMPSHIRE

(From the " Woodsman's Handbook," Table No. 12.)

Breast-height diameter (inches)	Height of tree (feet)											Basis (trees)
	30	40	50	60	70	80	90	100	110	120		
	Volume in board feet											
5	8	12	15	...	...	...	...	.....	.....	.....	.....	7
6	13	20	23	27	29	...	...	.....	.....	.....	.....	41
7	18	28	34	39	44	...	...	.....	.....	.....	.....	75
8	24	36	45	53	62	...	...	.....	.....	.....	.....	128
9	32	44	56	69	81	93	...	.....	.....	.....	.....	156
10	41	53	70	85	102	119	138	.....	.....	.....	.....	177
11	..	63	84	103	126	147	168	.....	.....	.....	.....	164
12	..	73	100	125	151	177	200	228	245	.....	.....	146
13	..	84	117	148	180	210	238	270	293	.....	.....	137
14	..	95	137	173	210	243	277	312	348	.....	.....	91
15	..	105	158	200	241	282	321	362	406	.....	.....	61
16	..	...	181	230	277	323	370	415	470	.....	.....	88
17	..	...	209	261	313	368	421	471	540	.....	.....	70
18	..	...	238	297	352	411	475	531	610	688	.....	68
19	..	...	270	336	393	460	530	598	682	763	.....	44
20	..	...	302	379	436	506	583	660	750	840	.....	35
21	..	...	...	425	480	553	634	720	820	918	.....	23
22	..	...	...	...	522	597	681	779	887	990	.....	16
23	..	...	...	...	566	639	727	834	958	1,065	.....	19
24	..	...	...	...	...	674	769	889	1,030	1,135	.....	9
25	..	...	...	...	...	706	809	942	1,105	.....	.....	12
26	..	...	...	...	...	737	846	994	1,180	.....	.....	11
27	..	...	...	...	...	...	...	1,046	.....	.....	.....	....
												1,578

The volume given is actual saw cut. Sixty per cent was round-edged, and forty per cent squared; seventy per cent, one-inch boards, and thirty per cent, 2⅛-inch plank.

Area methods

The quarter-acre circle method.— In this method it is assumed that a careful count and estimate of the trees on a part of the whole area (perhaps 10 per cent) may be used as an average figure for the entire tract; and that the estimate for an average acre, multiplied by the total number of acres, will give us an accurate estimate of the timber in the entire stand. One way in which this method may be applied is to make a careful estimate of the trees on a circle, the area of which is one quarter of an acre. The method is as follows: Select a part of the stand in which average conditions as to the number of trees, the height of trees, and the diameters of the trees are represented. Count and tally the logs in the trees on this quarter-acre as described in the tree-to-tree method. In order to be sure that you have an area of exactly one quarter of an acre select some tree, rock, stump, or other mark as the center of the circle and then count all trees that are found within a radius of 59 feet from the center. This 59-foot radius should be measured with accuracy since the estimate obtained on this quarter-acre is to be multiplied by a large factor in order to obtain the estimate for the whole stand, and a difference of only a foot or two in one direction or another may make a large difference in the result. If you cannot judge the 59-foot distance accurately by stepping or pacing,[7] this distance should be measured with a tapeline. Be sure to count all trees on the area once and only once.

After the trees have been tallied according to the number of logs and their top diameters, as already described, these logs may be scaled exactly as before, and the total contents of the plot may be determined by adding together the number of board feet in each log.

This method has much to recommend it: One man can do all the work unassisted. If the sample areas have been carefully selected and the work of estimating is carefully done, there is no reason why this method should not lead to fairly accurate results. In using this method the important thing to be remembered is that the sample plots chosen should represent average conditions. They should be neither too good nor too poor. It is often a temptation to select a plot that has very good timber on it — better in fact than the average — with the result that too large an estimate is obtained.

If the estimator feels unable to make a fair choice of sample plots, they may be taken at regular intervals along a compass line. This will eliminate the element of choice in the location of plots. The compass lines should be run in a direction that will insure crossing the different types, qualities, or age-classes; and the sample plots should be taken at regular intervals, perhaps every 20 or 40 rods, regardless of the density of the stand. Only in this way will an impartial estimate be obtained.

The number of plots selected should be sufficient to include representative parts of the stand. If conditions are variable, more plots will be necessary than if the stand is uniform throughout. As a general rule it may be stated that, when conditions are uniform, an estimate based on 5 or 10 per cent of the total area will be accurate enough. If conditions are variable, however, plots covering as much as 20 or 25 per cent of the total area may be necessary in order to be sure of accuracy.

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[7] The average man cannot step a full yard at one stride without a conscious effort, and to do this in the woods is tiresome work. It is recommended that, when measuring distances by pacing, a natural step be adopted; such a step is about 33 inches for a man of average height and is equivalent to six steps to the rod, or about 21½ steps for the 59-foot radius of the circle.

Rectangular-measurement methods.— In applying area methods, by which the trees on only a part of the entire tract are actually counted and estimated, it is not necessary that a circle method be used. Plots may be square or rectangular, so long as the exact area that they cover is known. When running long strips through the woods, acres are frequently measured 40 rods long and 4 rods wide. The essential point is to have a plot the area of which is known definitely. Plots that are square or rectangular, however, are usually more difficult to measure than are circular plots, and rectangular measurements should rarely be attempted unless two or more men can do the work together. Long strips through the woods, to be run to the best advantage, require the services of at least three men. For the owners of small woodlots, or for those who wish to do the work alone, the quarter-acre circular plot is recommended as the least difficult and the most practical method.

METHODS OF ESTIMATING THE CORDWOOD IN A WOODLOT

Trees that are too small to produce saw logs are best estimated as individual poles of specified lengths or else as cordwood. After the saw logs have been removed from large trees, there is often considerable

TABLE 6. SAMPLE FORM OF TALLY SHEET FOR ESTIMATING CORDWOOD

Species: Red, black, and scarlet oak Area: 10 acres

Breast-height diameter (inches)	Number of trees, by height						Reduced to cords, by Table 8
	Height of trees (feet)						
	30	40	50	60	70	80	
4	25*	40	30	......	......	......	2.60
5	8	30	10	......	......	......	1.81
6	......	60	65	......	......	......	7.15
7	......	20	15	30	......	......	5.22
8	......	5	42	60	......	......	11.27
9	......	......	18	52	......	......	9.37
10	......	......	8	41	......	......	8.06
11	......	......	2	36	4	......	9.20
12	......	......	......	2	18	......	5.80
13	......	......	......	1	9	......	3.52
Total cords	......	......	......	......	......	......	64.00

* In the woods, the trees are tallied by the dot-and-dash system, described on page 148. For simplicity, numbers are given in the sample.

material suitable for cordwood left in the tops. While it is difficult to give either suggestions or tables that will help in the work of estimating the cordwood in the tops of trees, it is possible to give tables that will enable one to estimate the amount of cordwood obtainable from trees of small diameter, provided the height is known (page 2066). In order to make this kind of timber-estimating possible, Tables 7 to 11 inclusive,

TABLE 7. AMOUNT OF CORDWOOD CONTAINED IN ONE CHESTNUT TREE, BY HEIGHT

Height of tree (feet)........	30	40	50	60	70	80
Breast-height diameter (inches)	Cords	Cords	Cords	Cords	Cords	Cords
4	.016	.021	.028	......	......	....
5	.024	.032	.042	......	......	....
6	.030	.043	.056	.067	......	....
7	......	.059	.071	.083	......	....
8	......	.071	.089	.109	.125	....
9	......	.091	.111	.132	.153	....
10	......	.115	.137	.159	.183	.196
11	......	.139	.166	.192	.222	.244
12	......	.164	.196	.227	.256	.294
13	......	......	.227	.263	.294	.333
14	......	......	.263	.303	.357	.385
15	......	......	.303	.344	.400	.455
16	......	......	.344	.400	.455	.525

TABLE 8. AMOUNT OF CORDWOOD CONTAINED IN ONE BLACK, RED, OR SCARLET OAK TREE, BY HEIGHT

Height of tree (feet)........	30	40	50	60	70	80
Breast-height diameter (inches)	Cords	Cords	Cords	Cords	Cords	Cords
4	.020	.027	.034	......	......	....
5	.031	.037	.045	......	......	....
6	......	.052	.062	.071	......	....
7	......	.067	.077	.091	.100	....
8	......	.083	.100	.111	.143	....
9	......	.100	.125	.137	.167	.200
10	......	.111	.152	.167	.200	.250
11	......	.149	.185	.217	.256	.294
12	......	.189	.222	.256	.294	.333
13	......	.238	.278	.312	.357	.385
14	......	.286	.322	.370	.416	.455
15	......	.345	.385	.435	.475	.500
16	......	......	.455	.500	.555	.588

have been prepared. They include the material in the trees of the several species down to a limit of two inches in diameter in the tops. The trees should be counted and tallied according to diameter and height, as indicated in the sample form of tally sheet, Table 6. The appropriate tables should then be applied to reduce the number of trees to cordwood.

TABLE 9. AMOUNT OF CORDWOOD CONTAINED IN ONE TREE OF WHITE OAK OR CHESTNUT OAK, BY HEIGHT

Height of tree (feet)........	30	40	50	60	70	80
Breast-height diameter (inches)	Cords	Cords	Cords	Cords	Cords	Cords
4	.020	.027	.034	......	......	....
5	.031	.038	.047	......	......	....
6	......	.053	.062	.077	......	....
7	......	.071	.083	.091	.110	....
8	......	.091	.105	.125	.149	....
9	......	.111	.133	.161	.192	.227
10	......	.133	.161	.196	.233	.270
11	......	.156	.188	.233	.270	.313
12	......	.185	.227	.270	.313	.370
13	......	......	.263	.312	.370	.416
14	......	......	.303	.357	.416	.476
15	......	......	......	.400	.475	.555
16	......	......	......	.475	.555	.625

Cordwood tables

For a few of the common species of trees found in our eastern woodlots, Tables 7 to 11 inclusive, show the approximate amount of cordwood contained in trees of different diameters and heights. These tables have been constructed from various sources; the volume in cubic feet has been used, and a converting factor has been applied that gives the contents directly in cords.[8] In using the tables:

Multiply the value given in the appropriate table for a specified height and diameter by the number of trees of that size. Do the same for all diameters and heights, and add the results together.

For example: In the tally sheet, Table 6, it will be found that the 25 trees, 4 inches in diameter and 30 feet high, yield .50 cord of wood (25 x .02 in Table 8). The 40 trees, 4 inches in diameter and 40 feet high, yield 1.08 cord (40 x .027). The 30 trees, 4 inches in diameter and 50 feet high, yield 1.02 cord (30 x .034). The total number of cords for all trees 4 inches in diameter is therefore the sum of these three values, or 2.60, which is placed in the last column. The same method is followed for all diameters. The sum of the values in the right-hand column gives 64, the total number of cords on the area.

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[8] The converting factors for chestnut and the oaks were taken from Bulletin 96 of the United States Forest Service. For the other species, bulletins 73 and 80 were consulted. While not constructed from trees growing in New York, these tables should give approximately accurate figures.

TABLE 10. AMOUNT OF CORDWOOD CONTAINED IN ONE MAPLE, BIRCH, OR BEECH TREE, BY HEIGHT

Height of tree (feet)	30	40	50	60	70	80
Breast-height diameter (inches)	Cords	Cords	Cords	Cords	Cords	Cords
4	.023	......	......	......	......	......
5	.031	.037	......	......	......	......
6	.040	.055	......	......	......	......
7	.047	.062	.077	......	......	......
8	......	.071	.091	.112	......	......
9	......	.091	.117	.147	......	......
10	......	.117	.141	.192	......	......
11	......	.139	.161	.222	.256	......
12	......	.161	.185	.256	.303	......
13	......	......	.227	.294	.357	......
14	......	......	.263	.345	.416	......
15	......	......	......	.400	.500	......
16	......	......	......	.455	.555	......
17	......	......	......	......	.588	.625
18	......	......	......	......	.666	.714

TABLE 11. AMOUNT OF CORDWOOD CONTAINED IN ONE HICKORY TREE, BY HEIGHT

Height of tree (feet)	30	40	50	60	70	80
Breast-height diameter (inches)	Cords	Cords	Cords	Cords	Cords	Cords
4	.016	.020	......	......	......	......
5	.025	.027	.040	......	......	......
6	.034	.040	.055	.071	......	......
7	.042	.055	.071	.091	......	......
8	.053	.077	.100	.111	.143	......
9	......	.096	.122	.149	.182	.222
10	......	.120	.153	.182	.222	.263
11	......	.149	.185	.222	.263	.312
12	......	.178	.217	.264	.312	.357
13	......	......	.256	.312	.357	.416
14	......	......	......	.357	.416	.476
15	......	......	......	.416	.476	.555
16	......	......	......	......	.555	.625

HOW TO DETERMINE THE STUMPAGE VALUE OF TIMBER

After it is definitely known how many thousand feet of lumber or how many cords of wood a given tract of land will yield, there still remains the problem of determining the sale value of the stumpage. This is a problem into which a great many factors enter, such as the cost of team-hire and labor, the distance of the timber from the nearest mill and market, the ease with which the trees can be felled, cut into logs, and hauled to the mill. There is such a wide variation in the cost of labor in different parts of the country, and so much depends on the relative accessibility of the timber, that the most satisfactory way of handling this question is to see how stumpage values are determined under a given set of conditions and then adapt the figures so as to apply to a particular case.

First of all, it may be assumed that the timber is so located that a haul of one mile is required to reach the mill, and that the mill is located in a town which has railroad shipping facilities. If at the same time the logging conditions in the woods are not difficult, the conditions are most favorable for the easy marketing of the timber; stumpage values should therefore be the highest. The necessary costs of operations in one typical case were as follows:

	Cost per thousand feet
1. Felling	$0.50
2. Trimming and sawing into logs	1.00
3. Skidding and loading	1.25
4. Hauling logs, a mile	.40
5. Sawing at mill	4.00
6. Piling, transferring, and the like	1.00
7. Loading and hauling lumber to cars, a mile	.35
Total	$8.50

This probably represents the most favorable conditions under which lumber can be produced. It assumes favorable conditions in the woods, moderate labor costs ($2.00 per day), and nearness to the mill and the shipping point. The difference between the total cost of operations ($8.50) and the local market price of the mill run of the species cut, minus an allowance for the operator's profit of 15 to 25 per cent, should be approximately the value of the timber on the stump. By "mill run" is meant the average of all the grades of lumber produced from the logs, just as it comes from the mill. Most woodlots will produce relatively small quantities of the better grades of lumber; therefore the mill run values will not be very high. For example, the mill run of hemlock lumber in a town in eastern New York sells at $18 to $20 a thousand feet, according to the location of the mill. The stumpage value can then be determined by the following rule:

Divide the selling price by 1 plus[9] *a fair percentage of profit; from this, subtract the cost of operations; the remainder is the stumpage value.*

Taking the figures given above for hemlock at $18 a thousand, and allowing a 20 per cent profit on operating costs, the operator will find that this rule works out as follows, giving a stumpage value of $6.50 a thousand.

$$\frac{\$18}{1.20} - \$8.50 = \$6.50, \text{ stumpage value}$$

Since the conditions outlined above are exceptional in that the timber is not far from the mill and the mill is situated at the shipping point, it may be fairer to assume that conditions are somewhat harder. Less favorable conditions might mean not only rougher, steeper ground in the woods, but also greater distances from the woods to the mill and from the mill to the shipping point. It may therefore be assumed that a haul of three miles from the woods to the mill is necessary, and that a haul of similar distance is necessary from the mill to the shipping point. The cost of operations in a typical case under these conditions was as follows:

	Cost per thousand feet
1. Felling trees	$0.75
2. Trimming and sawing into logs	1.25
3. Skidding and loading	1.75
4. Hauling logs, 50 cents a mile for 3 miles	1.50
5. Sawing at mill	4.00
6. Piling, transferring, and the like	1.00
7. Hauling lumber to shipping point, 40 cents a mile for 3 miles	1.20
Total	$11.45

It will be seen at a glance that these figures, which represent more nearly the average conditions of to-day, bring the cost of operations to a much larger figure, and that the difference between local market values for the mill run of the lumber and the cost of operations is much smaller. It follows that the stumpage value for all kinds of timber rapidly decreases as the distance from the mill and from the market increases, and also that the stumpage values decrease rapidly if the conditions under which the logging must be carried on are not favorable. In these days much of our timber is located in rather inaccessible places, so that the foregoing figures represent more nearly the average conditions.

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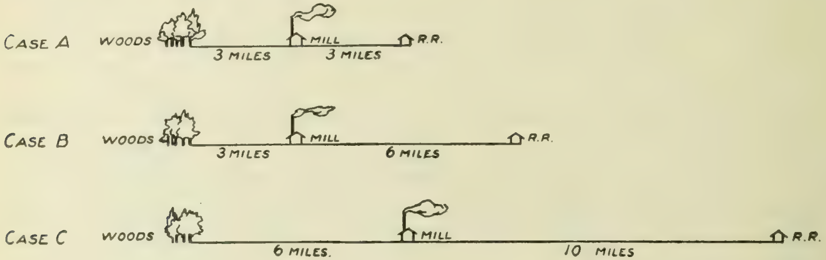
[9] The selling price is divided by "*1 plus a fair percentage of profit*" not only in order to cover all actual costs of operation, but to insure against losses arising from unexpected sources and to allow the operator some margin of profit to which he is justly entitled, because he assumes some risks.

In determining the cost of operations, each owner should estimate his labor at a fair price, and the cost of his team at a price that he would be able to get if he were hiring it out by the day. This is only fair because work in the woods is not easy, and it is always attended with some risk, both to equipment and to the horses employed. The following diagram presents in a graphic way how the costs in lumbering are distributed, and it may be of some help to those who are trying to determine the value of their timber on the stump:



	Cost per thousand feet
Case A.	
Fixed charges (felling, skidding, sawing, piling, and the like)	$8.75
Woods to mill, 3 miles, at 50 cents a mile	1.50
Mill to shipping point, 3 miles, at 40 cents a mile	1.20
Total	$11.45
Case B.	
Fixed charges, the same	$8.75
Woods to mill, the same	1.50
Mill to shipping point, 6 miles	2.40
Total	$12.65
Case C.	
Fixed charges, the same	$8.75
Woods to mill, 6 miles	3.00
Mill to shipping point, 10 miles	4.00
Total	$15.75

In each of the foregoing cases, the stumpage value may be determined by applying the formula already given. If the allowance for profit be placed at 20 per cent and the mill run be valued at $18 a thousand (a fair value for hemlock), the following results will be obtained:

Case A.

$\frac{\$18}{1.20} - \$11.45 = \$15 - \$11.45 = \$3.55$ a thousand, stumpage value

Case B.

$\frac{\$18}{1.20} - \$12.65 = \$15 - \$12.65 = \$2.35$ a thousand stumpage value

Case C.

$\frac{\$18}{1.20} - \$15.75 = \$15 - \$15.75 =$ a negative value

In Case C a negative value is obtained. This indicates that unless the operator is satisfied with a smaller percentage of profit, it will not pay him to attempt the manufacture of lumber under the conditions given. If a selling price of $24 a thousand could be obtained, as might be the case with white pine instead of hemlock, he could still afford to operate under the conditions given, for the formula would then show the following results:

$$\frac{\$24}{1.20} - \$15.75 = \$20 - \$15.75 = \$4.25 \text{ a thousand, stumpage value}$$

In determining the stumpage value of cordwood, much the same process may be followed out; the cost of getting the material to the mill (which in this case would probably be a small power-mill operated by the woodlot owner) would be perhaps a little larger than it would be in the case of saw logs because small pieces, such as are used for cordwood, are more expensive to handle than logs are. On the other hand, there is less expense in handling cordwood after it has been brought from the woods because the market is nearer, and the cost of piling and transferring to the shipping point is eliminated. A good cordwood market is very desirable, because parts of trees that would otherwise be unmerchantable can be worked up into cordwood and sold at a profit. In some parts of the State, cordwood brings as much as $5 a cord wholesale, for mixed woods, and as much as $6.50 a cord for special kinds, such as hickory, which makes the best fuel. When retailed, or sold delivered in the cities and towns, the price is much higher than this.

In certain parts of the State, woods of a particular species bring a very good price because they are used in the manufacture of some article of trade for which there is a great demand. For example, basswood or maple may be much in demand for veneers; or poplar, which in some places is almost worthless, may be in great demand for pulpwood. The presence of a plant that is engaged in the production of wood alcohol, acetic acid, and the like, may give a greater value than is usual to such species as beech and birch; or the presence of a local charcoal industry may in the same way afford a greater value to certain woods of the region. Local markets should always be studied carefully, and advantage taken of them. If cordwood brings a good price, the management of timberlands on a profitable basis becomes a relatively simple matter, because nearly all the product of the woodlot can be utilized and no special treatment is necessary. If the market for lumber is good locally, and there seems to be a steady demand for timbers of saw-log size, it will require a longer time to produce the material but it will bring a better price in the end. Clear, straight timber will produce lumber of higher grade and greater value than crooked, limby trees, and a little attention to the growth of the timber when it is young and vigorous will be repaid by the production of a greater proportion of clear, first-grade lumber.

SUMMARY

In conclusion it may be said that the value of timber, on the stump, depends chiefly on three things:

(1) The species, or kind, of timber.

(2) The operating costs, that is, the total cost of cutting, hauling to the mill, sawing, and transferring to the shipping point.

(3) The market conditions, that is, the supply and the demand.

The last of these three factors is particularly variable, and should be watched closely so that advantage may be taken of a good market.

In estimating the amount of merchantable timber in a piece of woods, two methods are open to the owner. In the case of small woodlots the trees may be counted individually, and the logs that they will yield may be tallied, so as to be scaled later. When the area to be covered is large, a certain proportion only is estimated in detail, and care should be taken to select stands that represent average conditions.

Unless the owner of woodlands can rely on contractors to do careful, honest work, with as little damage to young trees as possible, it will be better to supervise the work in the woods very carefully, or, better still, to do it for oneself. Careless woodsmen are likely to do unnecessary damage, and this source of loss should be avoided.

THE CORNELL READING-COURSE FOR THE FARM

The Cornell Reading-Course for the Farm aims to assist those who desire to read reliable agricultural literature. It provides an opportunity for those who are unable to leave their work to receive in their homes consecutive instruction on subjects of particular interest. The course is conducted by means of printed lessons dealing with practical agricultural problems. Certain lessons discuss fundamental principles which should be understood by those who wish to farm most successfully; others contain concrete suggestions or give detailed directions for the best practices. Below is given a list of available lessons showing the arrangement by series. The number of lessons available is increased by the publication of a lesson each month, which is added to the appropriate series. The new lessons are sent to readers as issued. Enrollment in the course is by series. Each lesson is accompanied by a discussion paper which contains questions on the important points in the lesson. If the discussion paper is returned it is read carefully, and a personal reply is made when information is requested. Another Reading-Course lesson in the same series is sent on the receipt of a discussion paper whether the questions are answered or not, as the return of a discussion paper indicates the reader's desire for further instruction. It is hoped that the discussion paper not only will assist the reader, but also will bring the College and the individual farmer closer together.

Often the most benefit from the Reading-Course has been derived by the organization of study clubs. When groups of persons discuss Reading-Course lessons together, there is an added interest and an opportunity for the exchange of ideas which results often in mutual helpfulness among members of the group.

AVAILABLE READING-COURSE LESSONS FOR THE FARM, ARRANGED BY SERIES

Residents of New York State may register for one or more of the series mentioned below by addressing The Cornell Reading-Course for the Farm, College of Agriculture, Ithaca, New York.

SERIES	LESSONS	
The soil	42	Tilth and tillage of the soil
	50	Nature, effects, and maintenance of humus in the soil
Poultry	6	Incubation — Part II
	10	Feeding young chickens
Rural engineering	8	Knots, hitches, and splices

SERIES		LESSONS
Farm forestry	12	The improvement of the woodlot
	28	Recent New York State Laws giving relief from taxation on lands used for forestry purposes
	40	County, town, and village forests
	62	Methods of determining the value of timber in the farm woodlot
The horse	14	Horse-breeding to increase the farm income
	46	Feeding and care of the horse
	56	Practical horse-breeding
Dairying	16	Practical dairy problems
	32	Composition of milk and some of its products
	54	The dairy herd
	60	Farm butter-making
Fruit-growing	18	The renewal of the neglected orchard
	22	The culture of the currant and the gooseberry
	36	Culture of red and black raspberries and of purple-cane varieties
	48	Culture of the cherry
	52	Culture of the blackberry
Farm crops	20	Alfalfa for New York
	24	The rotation of farm crops
	66	Meadows in New York (in press)
Stock-feeding	26	Computing rations for farm animals
Vegetable gardening	30	Hotbed construction and management
	34	Home-garden planning
	58	Planting the home vegetable garden
Plant-breeding	41	Improving plants by selection or breeding
	38	Principles and methods of plant-breeding
	44	Methods of breeding oats
Country life	64	The farm home and the rural school (in press)

The above list is correct to June 15, 1914. The demand may at any time exhaust the supply of particular numbers. Requests will be filled as long as the supply lasts.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

W. A. Stocking, Jr., *Acting Director* A. R. Mann, *General Editor*

COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 62 APRIL 15, 1914 FARM FORESTRY SERIES No. 4

METHODS OF DETERMINING THE VALUE OF TIMBER IN THE FARM WOODLOT

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of assisting the reader to examine and improve his present methods of farming. The discussion paper also aids in reviewing important points in the lesson. An expression of the reader's experience or opinion is one of the best ways of converting into working knowledge what has been read. Each discussion paper filled out and returned will be read carefully, and a personal reply will be made if information is desired.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT-GROWING, FARM CROPS, STOCK-FEEDING, PLANT-BREEDING, VEGETABLE GARDENING. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. *Persons who wish to receive the other lessons in this series should therefore sign and return this discussion paper whether the questions are answered or not.* The Reading-Course will endeavor to aid in the solution of farm problems and in the organization of study clubs, and to give references for advanced study. *The space below on this page is reserved for correspondence concerning Reading-Course work and also for names and addresses of any persons likely to be interested in the course.*

1. What log rule is used most commonly in your part of the State?

2. Is it satisfactory to both buyer and seller?

3. On small areas, why is it advisable to count and estimate the logs in each tree rather than to rely on volume tables?

4. How can you determine accurately the acreage of your woodlot?

5. Are portable sawmills common in your vicinity? If so, do they do satisfactory work?

6. How would you proceed to determine the stumpage value of your own woods, if you had several species of trees growing in them?

7. How can you test the accuracy of any log rule, as applied to logs in your own part of the country?

8. What are the principal uses for wood in your locality? Is the supply equal to the demand?

9. What allowance for defect must be made for the average run of logs in your locality? How do you determine this?

Name..............................

Address..............................

Date..............................

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COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 64 MAY 15, 1914 **COUNTRY LIFE SERIES No. 1**

THE RURAL SCHOOL AND THE COMMUNITY

Assets of the farm

FOREWORD

IT is the right of the farmers of New York State to receive information of progressive effort toward a better country life. Education is the fundamental means to this betterment, and we believe that many persons living on the farm are ready to help develop a better rural school education and that they are eager to learn how to begin. This lesson has been prepared in the hope that all may seriously consider some of the vital needs of the rural schools of to-day, and as soon as possible make effort to meet such needs. Let us all work together in the interest of the boys and girls of the State.

The Editors of the Cornell Rural School Leaflet

THE POINT OF VIEW

ALICE G. MCCLOSKEY

In this country much time and thought have been given to the development of the public school system in the larger communities, but there has not been very great progress in our rural schools. At present stronger endeavor is being made to help boys and girls in country districts to obtain a more efficient background for their part in the world's work. It will be many years before ideal conditions for such development can be brought about; but all must work together toward this end. The farmers, the farmers' wives, the school-teacher, the doctor, the lawyer, the pastor, and all professional people in the country round, the young men and women on the farm, the country organizations, the grange, the county fair, and all state and national educational institutions, must lend a hand to help in the development of a strong country-life background in New York State.

In this publication we are presenting some considerations which are important in the development of better rural schools. The country school offers opportunity for a more ideal education than the city offers, because educational processes can often be best worked out by means of farm experiences and practices and by means of the great out-of-door laboratory. It is important that many of the most efficient boys and girls in this country should want to live their lives in country places. The only condition that will bring this about is that country life shall offer opportunity for prosperity, and prosperity must be reached through education. The development of a better country life is based on economic problems. When such are met satisfactorily the social life will grow in fundamental ways. Let us take into consideration some of the essential lines of endeavor in the interest of bettering conditions in our rural districts.

THE BOYS AND GIRLS

The first thing to have in mind is that there is nothing more important on the farm than the children. It is their right to be fitted for life, mentally, morally, and physically. Young persons must be taught to meet life; they must have the example of efficient men and women about them; they must be taught to know themselves; they must be equipped to enter the great life struggle.

THE EDUCATION OF BOYS AND GIRLS

In many cases the school-teacher is considered responsible for the education of the boys and girls; the fact is that she can do but little unless she has the cooperation of capable persons in the community. The parents, the pastor, the country doctor, the merchant, the county fair association, the grange — these are among the teachers of boys and girls in the country districts. Each individual with whom the child associates is more or less responsible for the child's outlook, and each should seriously consider this responsibility.

THE NEW ATTITUDE TOWARD RURAL SCHOOL EDUCATION

Within the past few years a new activity has developed in the interest of better rural education. Out of this came a reorganization of the supervision of rural schools, and there is now a background for developing education in rural districts under more efficient leadership. The district superintendents of rural schools are ready to cooperate with every effort to promote better education in the country, and are giving time and thought to aid in working out school practices that will be suited to the needs of boys and girls in the country. Some of the questions of vital interest that are being considered by educational leaders are as follows:

1. *The social foundation.*— In planning country-life education we must have ideals of rural folk. Do we realize the significance of the term "country gentleman" as it was used in the past? Do we realize that there are persons in the world to-day who want to live with nature, to develop their own lives and the lives of their children by means of a digni-

fied industry such as agriculture, and who care to stand for a life that is intellectual and reverent? Do we realize that on such life the highest future development of the race must stand? With such a realization, are we solving any problems in the interest of country life by taking into country districts city methods of meeting life?

Must the rural church become an entertainment center in order that the boys and girls in the country will have a social life more to their liking? Would it not be possible to have as a background for effort the belief that the important need in the country to-day is an economic one? Cannot education in rural schools be sufficiently practical to enable boys and girls in the country to make a living on the farm? Would it not be possible to work out the problem of recreation in such a way that there might be wholesome sports and pastimes for country boys and girls; that there might be folk dancing on festival occasions and outdoor dramatic entertainments for gatherings at the fairs, festivities that will give young persons the opportunity for outlet and self-expression? These are important questions; and thinking persons believe that social progress can be made when right economic conditions prevail, and that nothing can be gained by trying to keep boys and girls on the farm by means of a temporary interest in artificial entertainment.

FIG. 81.— *Both are young, and both need care*

2. *Agriculture.*— All farmers should become familiar with the new lines of educational work and with modern ways of giving instruction in the subjects now considered fundamental to preparation for life. In many cases farm folk have defeated new educational ideas largely because they have not known why new work needed to be introduced into the schools. For example, we have heard farmers say, "I don't want agriculture taught in our school; I can teach my boy more agriculture than the teacher can." His statement is doubtless correct, but what he does not consider is that as soon as any subject becomes a part of the school work it is dignified in the minds of the children — and this in itself is important.

FIG. 82.— *What good cultivation will do*

The work of the teacher is to inspire as well as teach, and even interest in the subject on his part may often send some bright young mind into activities that will count for much in developing better farming. The regular school work — arithmetic, geography, language, and the like — very often may be taught advantageously by means of farm experiences and practices. A teacher may direct simple contests along agricultural lines; he may introduce some experiments in farm crops or gardens at school, in which a successful farmer in the neighborhood will help; and he may give credit at school for accomplishment in the business of farming at the home. More important, however, than any of these is the fact that many thinking farmers of to-day, who realize that educators are right in their efforts to teach boys and girls in the country in terms of farm life, are demanding that the teachers who give instruction in their schools shall have some knowledge of nature and some training in scientific agriculture. This point of view, if continued, will lead to special training of teachers for country life, so that they will be able to give instruction that has relation to the life and the surroundings of the children.

FIG. 83.— *Preparing for a lesson at school*

3. *Domestic science.*— Many mothers have objected to the taking of school time for teaching domestic science; and yet a little thought on this matter will at once reveal that, as soon as housework is dignified by being made a part of education, it is straightway given a new place in the minds of boys and girls. The rural school building can be made a demonstration of good housekeeping, and indeed many schools need this. The mothers can help. The Department of Home Economics at the State College of Agriculture will assist in directing such effort.

4. *Nature study.*— Parents in rural districts often state that they do not want their children wasting their time on nature study. This would not be said if those persons knew how valuable the study of nature is in the preparation for life. At great expense the school organizations in cities are trying to obtain such training for the boys and girls, and are making effort to use the public parks for this purpose. A study of nature develops keen observation in relation to natural objects and phenomena.

This background is most important for any farmer, since his success depends largely on his knowledge of nature. An interest in natural history will also give a country child many resources, for a good naturalist always has an active interest in the out-of-doors. One who has training in investigation in natural history does not need artificial entertainments such as those that have lured many of our country boys away from the farm.

Let us think seriously, therefore, of the importance of a natural-history background for every boy and girl in the country, and also of the ways and means of dignifying the business of agriculture, which is one of the most important industries of the world.

5. *Essentials to better manhood and womanhood.*— In the effort to render country boys and girls more efficient for a life work, whether they remain on the farms or go out into the world into other activities, we must consider all the essentials to their development that are a part of the best schools in the country. Whatever will make for better education should be thoroughly discussed in each rural district, and effort should be made year by year to strengthen each school.

6. *Good teachers.*— The most essential thing to better education is a good teacher. If a school is to make progress the teacher must remain for more than one year. Every rural community should therefore make effort to pay an adequate salary, and if a teacher is satisfactory her good work should be recognized by increased wages until a maximum is reached that will equal outside opportunity.

FIG. 84.— *Girls are often successful in raising poultry*

7. *A clean, attractive schoolhouse.*— The school building should be clean, comfortable, and attractive. It should be in good repair. In every pos-

sible way boys and girls should be encouraged to take part in keeping the schoolhouse in good condition, for when children are constructive they are less likely to be destructive.

8. *The interior of the schoolhouse.*— The interior of the school building should be made as attractive as possible. There is a tendency in rural districts to paint the walls drab because this color is considered durable. Before he makes his decision as to what color shall be used on the schoolroom walls, every trustee should ask the teacher to lend him the leaflet on the interior decoration of rural school buildings prepared by Mr. Farnum, of the University of the State of New York.

9. *The consolidation of rural schools.*— All educators and citizens of rural communities are considering the consolidation of rural schools. This is most important. If a district cannot provide wholesome school conditions and a good teacher, it may be best to unite with other districts so as to make a strong school center possible. All persons in farm communities should read carefully and thoughtfully the article by Dr. Thomas E. Finegan on page 175.

10. *School grounds.*— There should be a good piece of ground connected with the rural school, and every community should make effort to see how this can be brought about. This ground should then be made as attractive as possible. There should be a playground, and simple planting with plenty of space for instruction in agriculture if the teacher has the spirit and the ability to teach the subject. The outbuildings should be well screened and should be kept in a sanitary condition.

11. *Equipment.*— The schoolhouse needs equipment. There should be good blackboards, maps, and a globe. There should be a good library, since country boys and girls ought to be taught one of the great resources of life — the enjoyment of books. The library need not be large, but it should be well selected and kept in good condition in a bookcase in the schoolroom. The boys and girls in the country should have a musical instrument. A good organ is to be preferred to a cheap piano.

12. *Better health.*— The entire community should make every possible effort to help to strengthen the physical background of the boys and girls. Any effort on the part of the State to find out about the health of the children should meet with the cooperation and encouragement of all parents in the community. No boy nor girl can be successful in life if handicapped by ill health. Children have the right to the best knowledge of the times in relation to their health. In this connection there should be serious consideration of care of the teeth.

13. *Good houskeeping at school.*— Farm women should make concrete effort toward interesting the girls in their community in the modern ideas of home-making. Many of the higher institutions of learning are now

giving instructions along this line. In every community there are mothers and some young women who could do a real philanthropic work by holding Saturday classes for the rural school girls, or by going to the school and helping the teacher to give instruction along the lines of home-making. They can help the teacher and the boys and girls to demonstrate good housekeeping by means of the rural school itself. With the right encouragement from the community the rural school teacher will be glad to aid in the education of boys and girls in such work.

In New York State, then, let us all make a strong, persistent effort to have the best possible educational centers for the boys and girls on whom the responsibility of the growth of state and nation must eventually fall. Since the lives of many of these are to be spent in country districts, let us see that they have opportunity that will fit them for this life. Let us constantly keep in mind the following:

FIG. 85.—*Many hands at work*

1. A better school building.
2. Better school grounds.
3. Better equipment.
4. Better health.
5. Appreciation of the dignity of the business of farming.
6. Appreciation of the dignity of home-making.
7. A knowledge of nature.

8. A well-selected school library, however small — a library that will contain books of history, travel, poetry, fiction, and agriculture, a good reference book, and a good dictionary.

9. Education in the open air; trips afield.

10. Agricultural contests. Let us make it possible for district superintendents and rural school teachers to conduct agricultural contests and exhibits at the county fair without too much expenditure of energy on their part. It is difficult work, and needs the support of every farmer and farm woman in the community

There are rural school districts in which the foregoing problems are being worked out in fundamental ways. Here and there better school buildings are appearing, better equipment, better teachers, and courses of instruction that relate directly to country life. The men and women on the farm are cooperating with the teacher in order to make their school the best in the State. In such communities the highest form of philanthropy is being worked out. Some day we hope to publish a bulletin giving a report of concrete developments of this kind. Will your community be represented in this report?

FIG. 86.— *There should be practical instruction in agriculture*

THE CONSOLIDATION OF RURAL SCHOOLS

Thomas E. Finegan
(The University of the State of New York)

The present school-district system had its origin in the law enacted in 1795. The changes in the condition of the country and the advancement in our civilization have been tremendous since that date. When schools were organized under this law, it was on the plan of associated effort. The inhabitants in the settled parts of the State banded together for the purpose of maintaining a school. As the settlement and the development of the country extended, new associations were organized and, under the law of 1812, school districts were formed, the entire territory of the State being organized into such districts. In these early days the simplicity of the course of study, the number of children to receive instruction, and the relatively small expenditure for the maintenance of a school enabled the people of the State to maintain satisfactory schools on the plan of school-district organization.

It is not possible to continue the organization of the school system in the rural regions on the present plan. There are 1400 school districts in the State having an assessed valuation of $20,000 or less, and there are 4000 such districts having an assessed valuation of $40,000 or less. This means that each of these 4000 districts must depend for its financial support on ten farms with an average value of $4000. In about one half of these districts the average daily attendance is less than ten. It is not possible to maintain a school of interest with so few children and with so little property for its support. The two most essential elements in the maintenance of a school are a sufficient number of children to properly grade it, and a sufficient amount of taxable property to support it without such taxation's being burdensome. These two principles of school administration are being recognized throughout the entire country. For several years there has been a movement favorable to the consolidation of weak country school districts so that a greater number of children, a larger amount of taxable property, and more public funds may be brought to the support of a single school. By the establishment of consolidated districts, courses of study adapted to the needs of the agricultural sections may be given; trained teachers, who are familiar with the problems of rural life as they exist to-day and who can intelligently lead in the movement for the solution of such problems, may be employed; the investment of the people in the maintenance of the school will give better results; and the expense of the maintenance of the single enlarged school will not equal the expenditure for the maintenance of the several weaker and poorer schools. In other words, the consolidation of country districts means better schools for the same expenditure of funds.

The education law was amended by the Legislature of 1913 by providing that the voters of two or more rural school districts may come together in joint meeting and vote on the consolidation of such districts. A majority vote of each district is necessary in order to bring such district into the consolidated district. There is nothing mandatory in the provisions of the law. The law merely authorizes the people to determine for themselves whether or not they desire to consolidate their weak, poor schools and have stronger, better schools without a greater expenditure of funds. A strong school, providing instruction adapted to the present agricultural needs of a community, is a greater financial asset to a farm than is a weak school, which is unable to provide the instruction that the children living on farms in this State are entitled to receive. The following illustration will show the effective results that may be obtained under the law enacted by the last Legislature:

There are three school districts, numbers 1, 2, and 3, which may be consolidated into a district known as No. 2. District No. 1 has 15 children, has an assessed valuation of $30,000, and receives from the State $175. It expends $450 a year for the maintenance of its school. District No. 2 has 12 children, has an assessed valuation of $20,000, receives $200 from the State, and expends $450 for the maintenance of its school. District No. 3 has 20 children, has an assessed valuation of $39,500, receives $175 from the State, and expends $500 for its school. It costs these three districts $1400, in the aggregate, to maintain such schools as they are able to provide. If these districts were consolidated into one district, the consolidated district would have 47 children, would have an assessed valuation of $89,500, and would receive $550 in public money from the State — an amount equal to the aggregate amount that was apportioned to the three separate districts. Two trained teachers could be employed in the consolidated district, and the division of the work necessary in order to give instruction to 47 pupils would give each teacher an ideal number of pupils to properly instruct and to give the individual attention that is essential. The expense of employing the two teachers in the one school would not exceed the expenditure now necessary in order to maintain three teachers in three separate schools.

In recent years there has been no movement looking to the improvement of the educational facilities in the agricultural sections of the State, which is of more importance than the one intended to bring about the consolidation of weak school districts. This movement is one which should receive the thoughtful consideration of every intelligent citizen of the State. Every superintendent, school officer, and farmer should cooperate to the end that the funds which are unwisely expended in the maintenance of poor schools may become a valuable investment by being expended for the maintenance of schools that shall afford the instruction needed in the schools maintained in the farming sections of the State.

THE RURAL SCHOOL-TEACHER

H. DE W. DE GROAT

(Principal of the Cortland State Normal School)

Until the last few years the rural school has not received the help and the encouragement due it. Indeed, it is only recently that we have awakened to the fact that, in spite of added modern comforts and conveniences, there is really only one thing that will keep the boy on the farm, and that thing is the right kind of school — which is only another way of saying the right kind of teacher. As a matter of fact, most of our rural schools have been most decidedly unfitting ambitious boys and girls for farm life and have actually driven them away from it. The boy who at twelve years has not a real love for the country and for country life, on entering the village school may be counted as forever lost to the farm. The things that he admires and the future to which he aspires are to be found only in larger centers of population.

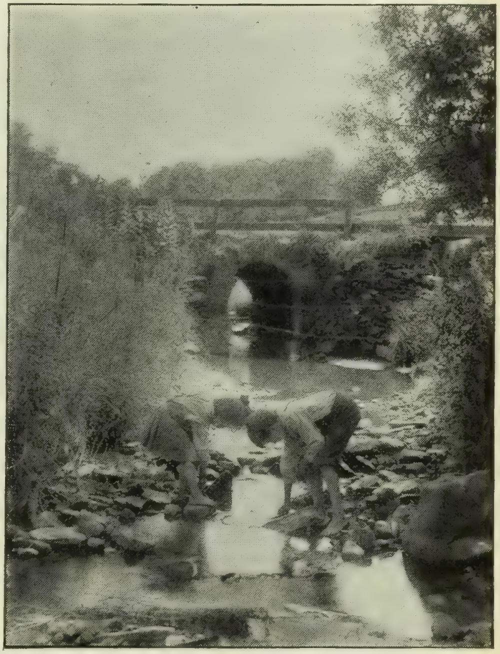


FIG. 87.— *The study of nature should be encouraged*

The rural school-teacher should be a trained teacher, possessed of the qualifications of the best teachers of elementary schools, for there is no reason in the world why the country boy or girl is not entitled to just as good teaching as the village or city boy or girl. Not only should the rural teacher be trained, and not only should she possess all the qualifications of a first-class teacher, but there are other essentials that are imperative if the rural school is to fulfill its proper function.

It is highly desirable that the young woman who teaches in the rural school be a product of the farm. In such a case the teacher has had the opportunity to know country boys and girls, and is in a position to understand the men and the women who are patrons of the school and who should be most interested in the school maintained by the particular community. The teacher should be thoroughly in sympathy with country life. She should understand in a general way common natural phenomena and should appreciate their significance. She should be a close observer, and one so in love with the great world spread out around her that her enthusiasm for it will inspire in her boys and girls a real love for the beautiful in nature and a desire to understand more fully the significance and utility of the things that they can see constantly if they will only look about them.

If a city girl is to be employed, she should possess adaptability to adjust herself to rural conditions. In most cases city girls turn to the rural school as a means of temporary employment to be followed by service elsewhere; but alas! the same thing has in the past been true of too many country girls. The city or village girl is not likely to understand country life, while all her associations have tended to unfit her for valuable service in the remoter rural schools.

The teacher should be a part of the community in which she is teaching. Its interests should be her interests. She should make it her purpose to know all the residents of the community, and she should strive to gain their respect and confidence. She should study the soil conditions and the products of the locality. She should study also the most modern and the scientific methods employed in the production and marketing of these products. To be sure, such knowledge may have little practical application in the way of advising farmers and farmers' wives, who may know much more about such things than she does herself; but it will at least convince the residents of the district that their teacher has a real and wholesome interest in what is going on about her, and that she is really a part of the community.

In referring to the teacher I find myself saying "she," but certainly it is highly desirable that all the good men available for the work be employed in rural schools.

If better teachers are to be procured for our rural schools, a threefold responsibility is involved, resting on the State, on the rural community itself, and on the teacher. The State must make the necessary provisions for training these teachers. It should, and doubtless will, soon enact laws affording a combination of districts from which will come larger schools and greater enthusiasm, and bringing about some change in the manner of the assessment of property for school taxes so that the burden of excessive local taxation that exists in many places will be distributed over larger political units.

The community, too, must share the responsibility. I realize that, as the desirable rural teacher, I have described a person whose services in other lines of work would command a high market value, and the district must meet this condition by paying an adequate salary if an efficient school is to be maintained. In many a district to-day worthy teaching can hardly bring happiness to the teacher, who may be working in a schoolroom perhaps wholly unattractive and compelled to live in comparative isolation owing to the neutral attitude of her neighbors.

One of the common reasons for applications for temporary licenses heretofore has been, " a teacher cannot find a place in the district to board, and one of our local girls who has not earned a license can live at home and teach the school." The trustee should remember when he takes the office that a good boarding-place for the teacher may contribute more to the efficiency of the school than much time and thought expended in other ways. The chief district officer, then, owes it to the school district and to the teacher to put forth every effort to find for the teacher a boarding-place in which she can be happy.

FIG. 88.— *Learning in the field*

I believe that the community should meet the teacher halfway in the effort toward mutual understanding, and in order to reach a better working basis for the improvement of the school — and, through the school, for the betterment of the community itself.

The responsibility of the third party, the teacher, I have already attempted to set forth.

THE COUNTRY SCHOOL

John R. Boardman
(Lecturer on rural education)

What shall we do with the country school, and who shall do with it? It is commonly conceded that something needs to be done. It would be better to say that many things need to be done, for the simple reason that, the more things there are to do, the more people will have a chance to help; and this is what the country school needs most — to be made the center of thought, interest, and service for the entire community. Everybody should be doing something to make the country school bigger, brighter, and better. It is one of the big tasks in country life to-day — perhaps the biggest. Its very bigness makes it attractive. It appeals to the biggest and best men and boys, women and girls, in the whole community, and they will find work to do that calls forth all the wisdom and talent which they possess.

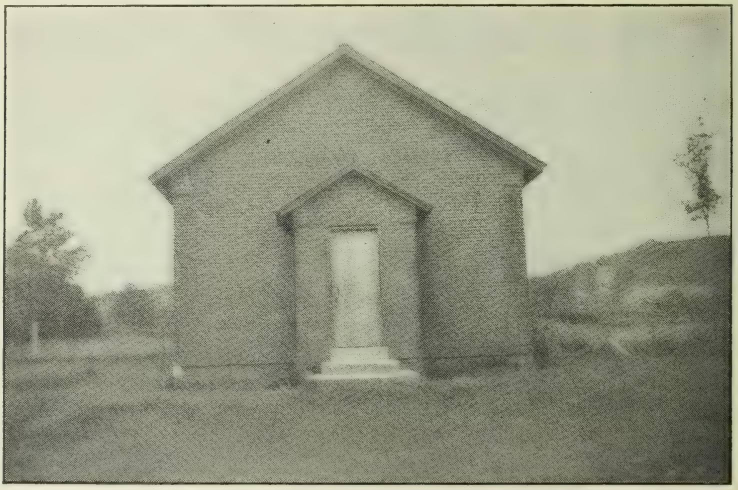


Fig. 89.— *The approach is not inspiring*

If the school in any rural community in New York State to-day is not such a center of common thought, interest, and service of the best people in the community, it must be because the people in that community are not so very big after all — smaller, perhaps, than the boys and girls who attend the school. It cannot be otherwise. The rural school holds the mirror up to the rural community and reflects the real value of its life with almost unerring accuracy.

Point to a school building out of repair, and you will find the reason in the rickety condition of people's educational standards and ideals. Pick out a school yard without trees and flowers and a roomy playground, and you will find no small measure of ugliness in the people who are satisfied to send their children to such a dreary place without a protest. Find a schoolroom with miserable desks, cheap blackboards, cracked stoves, and tin pails for drinking water, and you will not have far to go to find men who have no conveniences for the wife in the kitchen and no attractions for the children in the parlor. Locate a school presided over by a poorly paid, miserably trained teacher, and the men who value dollars above children will be patting each other on the back in the "cracker-barrel crowd" at the corner store over the small appropriation made each year to maintain the school.

There is no use in trying to dodge these facts. If they hit me and my community, it is my fault. If they represent my interest in my children, I am to blame. If they show up my own ignorance, I cannot escape. If they prove my niggardliness and false economy, I cannot plead "not guilty." The one great fact which rebukes me most is the fact that my own children and those of my neighbors must pay the price. They have to do without decent toilet accommodations, they have to suffer with the cold, they have to sit in cramped positions until their bodies ache with protest, they have to take the drafts that blow through the windmill called a schoolhouse, they have to pay the penalty of dwarfed minds because the teacher is little better than an ignoramus. My children and those of my neighbors pay the price! Don't let me forget this!

I wonder how long it will be before I wake up. I wonder how much worse conditions must become before I put my hand and tongue and pocketbook to use in order that my children and those of my neighbor may have their rights in the schools in my community. I wonder how long it will be before my pride will rebuke my penuriousness, before my loyalty to my community will get the best of my indifference, before my love for my children and for other children will take the place of an almost criminal neglect of their highest good, before the claims of the school will cast out my selfish concern for my personal and immediate interests.

It will be a great day for every New York country school when the people whom it so heroically tries to serve give it a fair chance to make good. Everything will be possible in the day when every man gets into his jeans gladly, with enthusiasm, and helps to make a real country school in his district. It will be a great day when we forget the number of mills on the dollar demanded in the item for schools in the tax assessment, and walk up to the superintendent or the teacher and put down some good, hard dollars that the tax-collector does not have to chase us in order to collect, and pry out of our pockets when he gets us in a corner.

We are going to have some great country schools when the farmers are awake to their own interests. Many have already cut their school wisdom teeth. You can tell it by the way the schoolhouse looks, by the way the pupils grow in health, knowledge, and morals, by the size of the salary paid to the man or the woman who stands behind the desk at the other end of the room, and by the whole tone and appearance of the community.

After all, the real difficulty is not in schools, it is in farmers and other folks. Schools only tell what people are, or are not. And schools never lie; they are brazenly, rebukingly truthful. There may be some miserable schools in your community, some inefficient teachers. They will not be there when you really find out how poor they are. You won't stand for it. You will rebel, strike, fight — do anything and everything that is reasonable and right in order to make things better. And then another farmer, perhaps a childless one or an old bachelor who pays taxes, will rub his eyes and get the vision of what things ought to be, schoolwise, and he will strike hands with you in the new task of making the school in your community what it must be in order to be worthy of you, of him, of the place, and of its splendid childhood.

And when things have been made a little better, the real citizen does not stop there. The fake citizen quits. A little paint, a few panes of glass, a patched roof, a new stove, perhaps some new desks, or a new building! Is that all? No! These things only whet the real citizen's appetite. These things give him an idea of what the real school will be when it comes to his community. He knows the good is always the enemy of the best. What he really wants is the best for his neighborhood, his own children, and the children across the meadow.

And he hasn't really missed the cash. He will not admit it if he has, when he sees that new school with its up-to-date equipment and its efficient teacher. He is a real citizen, and he knows that real citizenship costs money. It may come high, but he must have it for the sake of the children in his own home and in other homes.

Now for a long, strong pull for just this sort of school citizenship in every rural community in New York State. Let every man get ready! Go!

HELPING OUR RURAL SCHOOLS

G. A. LYTLE

(A farmer)

That a man can lead others no higher than he himself is able to climb, is an axiom true the world over. Before a farmer can be of much help to a group of students in a rural school on their upward climb, he must have an ideal toward which he himself is climbing and he must be well on the way.

I am afraid that the majority of our farmers have all too little interest in their own progress, let alone having an interest in the progress of the pupils of their school district. Too often they begrudge the money necessary in order to maintain a suitable school building and a competent teacher, and any departure from the traditional routine is looked upon as being " high-flown." In most localities, to suggest the beautifying of the school grounds or the establishing of school gardens would be considered revolutionary.

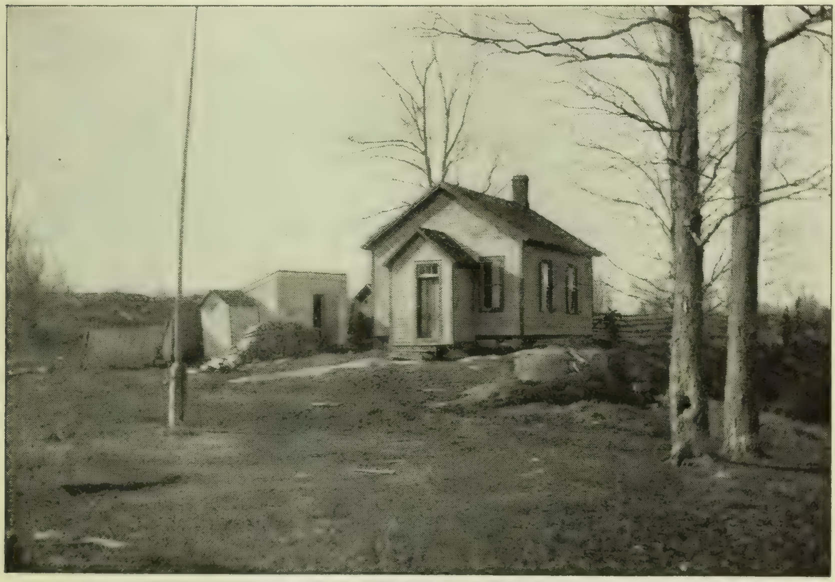


FIG. 90.— *Opportunity for improvement*

A progressive farmer may do much, however, toward stimulating interest in farm life among the pupils of his district if he is willing to give a little time and thought to the matter. For example, suppose there are one or two modern farms in the community. Perhaps they are the playthings of some wealthy city men, but they are equipped with all the modern conveniences, silos, blooded stock, well-kept barns, and the like. A trip to one of these farms could be arranged for some afternoon when the teams are not busy. The working of the machinery might be explained, the distinctive points of the live-stock indicated, and the general scheme of the farm outlined. The next day a description of the trip could be made the subject of a writing exercise, and so the details could be fixed in the minds of the children. Such a trip would at least tend to get the boys out of the rut in which their fathers travel, and at the same time provide the essential thing in life — the ideal.

Again, there are " best " dairies in every locality. An interested farmer could arrange with the teacher and the owner of the dairy for a visit, and find a way to provide the necessary transportation. With a little preparation the points of good dairying could be brought out, with reasons, the feeding combinations explained, and the general care of the dairy described. The older boys might be asked to pick out the best cow in the herd, giving their reasons for the selection; then the owner could tell them which one had proved her right to the title by performance. Of course, to do this right would require that record be kept of the yield of the individual members of the herd.

On another day a chicken farm might be visited, or a hog farm or a creamery or a greenhouse. Children are not likely to visit these places without an invitation, and if they do the visit is of little benefit unless there is some one to explain what is seen. The writer was born and brought up in the dairy district near Elgin, Illinois, yet not until he was a grown man did he visit a creamery with a view to finding out the reason for things associated therewith. Even to-day there are probably dairy farmers who cannot tell how the percentage of butter-fat in milk is determined. Few of them are interested enough to ask to have it explained, although it is the basis on which the price of their milk is figured.

If our boys and girls are to become good farmers (for the farmer's wife is often the better farmer of the two), they must see good farming conducted; they must see it in all its branches, and, the more they see, the larger will be the fund of knowledge from which they may draw in later years. If they are to become interested in farm life they must be helped to see the best side of it as well as the worst.

I know a meat-packer who sends his superintendents every year to visit the various packing plants of the country, in order to keep them in touch with the up-to-date methods of the business. He considers it a good investment. And I know dairy farmers who look on a pure-bred sire as a needless extravagance. Perhaps such visits as I have outlined would be good for the farmers themselves, because of the ideas that would be presented.

I recall a visit of a wealthy city "farmer" to a modest farm, some time ago. While there he saw a portable hog-house — an economical product of necessity. He examined it carefully and asked many questions about it. To-day he is using many duplications of it on his extensive farm. He said afterwards that that visit solved a problem which had been bothering him for some time, and saved him many dollars.

But to get back to the pupils. Our boys and girls need to be interested in farm work and farm life if we are to keep them from the cities and on the farms, and we farmers must create and maintain this interest personally. We can scarcely expect an underpaid, overworked, transient teacher to do it satisfactorily. It must be done by personal contact with the teacher. These visits will establish that contact. The offering of prizes for the best corn and potatoes raised by pupils would be beneficial. Lectures on agricultural subjects could be arranged during the winter months, either in the schoolhouse or in the community church. The feeding of pigs and chickens on the school grounds, and the keeping of the necessary records, would be entirely practicable.

But, above all and before all, the farmers themselves need to get into the spirit of the thing. A respect for the calling needs to be promoted. A desire to help every member of the community — a community spirit — needs to be developed, if the business of farming is to be what it really is entitled to be.

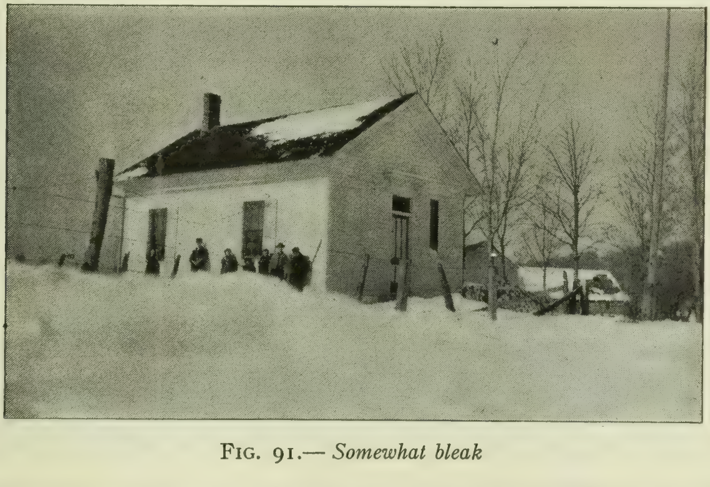


FIG. 91.— *Somewhat bleak*

Progressive men are to be found in every school district in the State, and on these men rests the responsibility of interesting the boys and girls in farm life and helping them to a higher standard of life and work.

Just look around you and see whether there isn't something you can do to help interest the boys and girls of your school, and then DO IT.

WHAT A HOME MAY CONTRIBUTE TO EDUCATION

LAYTON S. HAWKINS
(The University of the State of New York)

Not long ago a friend of mine said that he was having some difficulty in finding enough work for his boy to enable the latter to earn his living. "Surely," said I, "you do not expect that twelve-year-old boy to earn his own living." "Well," he replied, "it is probably true that not many men would feel like paying out an equivalent of what Jack costs for the amount of work which he does, but I think he does enough to make him feel that he is not an altogether useless member of this household." This man is the happy medium between the one who furnishes his boy with everything and expects him to make no return except perhaps to keep up his studies in school (which of course he does not always do even with no other work on his hands), and the man who demands from his boy every possible minute of time and ounce of strength with very little return in the way of food, clothing, shelter, and schooling. This friend of mine is looking forward to the time when his son will have to do his share of the work of the world. In this family society he is giving the boy a training which will lead to a useful life.

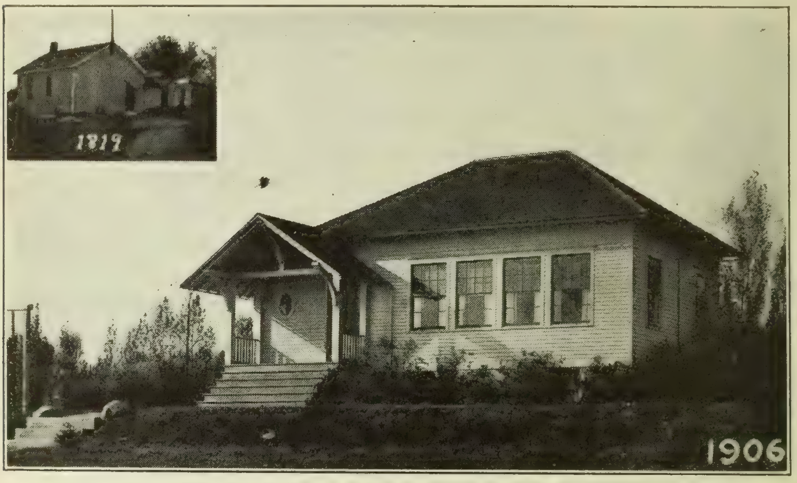


FIG. 92.— *A remodeled schoolhouse*

Jack has money to spend, but he earns it. Besides his regular share in the work of the household there are odd jobs for which his father pays him on the same basis as he would any other workman. The neighbors know that Jack is ready for all the odd jobs for which he has time. Since he is reliable and honest, there is usually waiting for him all the work that he can do. He has a surplus of garden produce which he sells to the neighbors or to the village storekeeper. His pen of White Wyandottes brings him a regular income. While Jack has money to spend, he does not spend it all. He knows what money means in terms of stored-up energy, and he therefore expects to get value received for every dollar spent. This does not mean that Jack is stingy, but that there are things which he really wants and for which he is saving his money. He is learning the lesson of value and judgment.

Jack's father has learned some things, during a life spent partly on the farm and partly in the practice of medicine in a small village. As soon as Jack was old enough to handle a hammer, he was furnished with old pieces of leather, tacks, boards, and whatever else was necessary in order to construct the crude and, to all but Jack, nameless contrivances which to him were so real. Father usually assisted with advice, and was always an appreciative audience at the exhibition performance of the machines. As Jack grew older, new tools were one by one entrusted to him. He now buys all his own lumber, dry cells, and other materials. He is not a master mechanic nor a cabinet-maker, but he can do a better job in wood or iron than many a grown man. For two years now Jack has had entire charge of the home garden, although he employs "dad" for a day or two during "planting season." During the seven years in which he

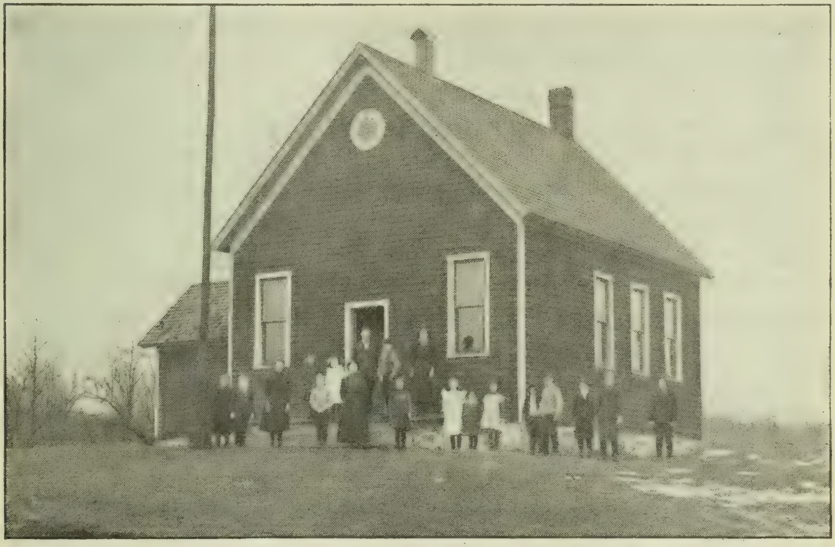


FIG. 93.— *A modern schoolhouse. Compare with the one shown on page 186*

has been connected with this garden, Jack has propounded numberless questions about growing things which his father has been unable to answer, and also numerous others which have met a more satisfactory fate. He is just now taking a great interest in the question of plant-food, and his father is turning his medical knowledge gardenward. All the eighth-grade boys are members of a " corn-growing club," and this no doubt accounts for the sudden attack on " scientific agriculture," as Jack calls it.

Jack has read tales of hunting and adventure, of chivalry and war. His father has revived from his boyhood memories and his later reading all that would be of assistance in constructing wigwams, lassos, lances, shields, and headdresses. The back yard has been the gathering place for tribes and clans from all regions and climes. Jack can swim, box, and play baseball and football, and has a lively interest in all the boy sports in vogue.

As a student in school Jack has attained a fair standing. His parents are regular attendants at the neighborhood meetings held in the schoolhouse. They know something of what is going on in the school. Jack's father not only has a high ideal of what an education means to a boy, but also is ready to contribute his share in giving a real educational opportunity to his boy. He has no money to throw away on taxes; he therefore insists that enough money be invested in school equipment and teachers to maintain an efficient school. He wants a clean, well-heated, well-ventilated building and a healthy, wholesome, well-trained teacher.

Even a more excellent opportunity than Jack's home offers, does the farm home offer for the parent who is disposed to assist in the education of the children of that home. The district school has deservedly received much criticism, but if parents are desirous of having a real education open to their children they should not only see to it that the taxes are kept reasonable and a fair return made for the money invested, but also be ready and willing to supplement the work of the school by developing the home opportunities for education. Work is educative. Drudgery is deadening. Work is doing things with a reasonable understanding of why they are done and with an end in view. Drudgery is doing things because one is compelled to do them.

Education means something more than securing a certain amount of information. It means ability and willingness to do one's share in the world's work. It means pulling one's own weight and a little more in the ship of state. It means a desire and an ability to contribute to the progress of civilization.

THE FARMER AND THE TEACHER OF AGRICULTURE IN THE HIGH SCHOOL

CHARLES B. TAYLOR
(Teacher of Agriculture in the Hancock High School)

During the last three years a new force has appeared among the influences that are molding the rural life of New York State. Prior to that time many of the farmers throughout the State had voiced the need of more practical teaching in the schools. The fact that the farm boy continued high school beyond the first or the second year was accepted as a declaration that the boy intended to leave the farm and go to college, or enter one of the professions, mercantile pursuits, or other lines of work for which the high school fitted him.

Arithmetic helped him to figure. Language helped him to write business letters. The other subjects trained the boy to think better, or were somehow a virtue in themselves. No thought, however, was given to the study of agriculture as a profession for which the school might give a training. Soils and fertilizers, dairying, animal husbandry, farm crops, fruit-growing, and the like, are new subjects for study in the schools of this State, and they form a sharp contrast to the old type of school, in which abstract English, mathematics, sciences, and languages, were taught. In the thirty-four communities where the former subjects have become a part of the regular work of the high schools, they have been welcomed by large numbers of practical farmers.

These schools are generally equipped with a workshop for instruction in simple mechanics, fairly complete agricultural libraries, laboratories, and equipment for instruction and investigation along agricultural lines and for demonstrating agricultural principles. These materials are held not only for the use of pupils, but also for the accommodation of the surrounding farm community.

In each school a specially trained teacher is in charge of the work. Practical farm experience is considered an essential part of his special training. The State pays two thirds of his salary. It is the intention of the Department of Education that he shall spend a considerable part of his time in extending technical agricultural information to the farming community. The instructor is expected to visit the farmers of the community, study their needs, and assemble them for farmers' meetings, extension schools, demonstrations, lectures, and the like. A very important part of his work is the supervision of the work of boys who are putting into practice on the farms those principles that they have learned at school. The schools are prepared to act as local agricultural bureaus. In short, the schools of agriculture should become the center of the agricultural interests of the community.

In general, no large tracts of land have been turned over to the schools. The theory is given in the school, while the practice is carried out on the home farm. In this way an excellent opportunity is afforded for the spreading of knowledge throughout the community to adults as well as to pupils. The school should, in turn, be greatly strengthened from this contact with the community.

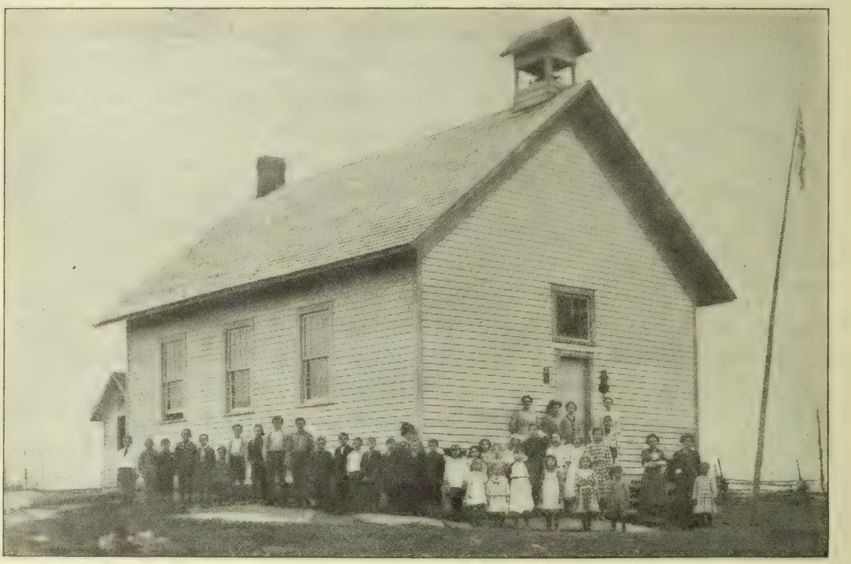


FIG. 94.— *Consider this building from the standpoint of location, architecture, and surroundings*

I wish every farmer in New York State would ask himself the following questions:

Is our local high school maintaining an agricultural course? If not, why? If so, am I doing anything to help make that school a success and to dignify its position in the community?

Have I confidence that the teacher of agriculture can take his footing on a business basis with the farmers of the community and really do something to make their business more successful? If so, have we made use of him in solving any of the problems that we have met in our work? Have we talked over the conditions of our district school with him?

Do I talk over the subject matter learned by my boy and my girl in the agricultural school? Do I encourage them to put this knowledge into effect?

Has the agricultural department of the high school tested my dairy for butter-fat or my soil for acidity?

Have I invited the instructor to visit my orchard, stables, henhouses, fields, woodlots, or silo?

Have I talked over my plans for my new barn with him?

Finally, have I asked him to help me to set up a system of accounts by which I can know at the end of the year which branches of my work are on a paying basis and which are not?

Now that there is an agricultural department in the high school which your older boys and girls attend, it can hardly fail to dignify the farming profession in the minds of the young persons in the vicinity.

And the rural school! Are the younger boys and girls to be deprived of all connection with their real life interests during the best six hours of every day which the law requires them to be in school? Surely there is scarcely room for the addition of agriculture to the already overcrowded list of things which the rural school teacher is expected to teach!

The rural school is nearest the life of the farmer and should be an explanation and unfolding of the life of the community. I fear that instead it is often a weak copy of the city type of school. It is ludicrous to see an attempt at formal grading in a school of ten pupils five to ten years of age. I fancy that many of the troubles of the rural school teacher arise from such an attempt. I fancy, too, that many troubles of discipline and much loss of interest arise from the failure of the teacher to interpret

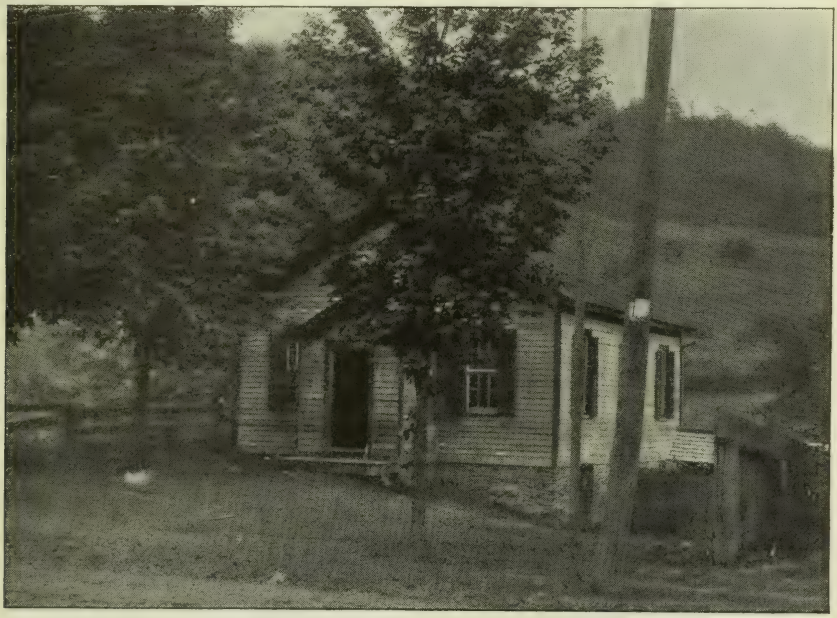


FIG. 95.— *An attractive location*

the arithmetic, language, history, and geography in the child's life and experience and the failure of the district to provide a school building and furnishings that are comparable in dignity and comfort to the average home of the district.

The school of agriculture in an agricultural community can hardly help extending its influence to every child of school age. The teachers in the rural schools come almost entirely from the local high schools and training classes. In many instances they know practically nothing about the scientific principles on which farming is based. In the high school where agriculture is an established part of the curriculum, many of the girls who are preparing to teach in the rural schools are being instructed in agricultural subjects. There are twenty-one girls in my agricultural classes, twelve of whom are preparing to teach school. In this direction I can see a possibility of much benefit from the agricultural high school, and I am glad to see school trustees demanding teachers who have taken agricultural work in the high schools. In at least one instance a Saturday class in agriculture has been conducted by the teacher of agriculture for the rural school teachers of the neighborhood.

Altogether, thirty-four high schools in the State of New York have looked beyond the horizon of their own school-yard fences into the countrysides of thirty-four sections of New York State. They have found themselves apart from community interests and community sympathy. In order to take their true place as a part of the community life, these schools have opened their doors to the community. They have divided their work to fit those who are preparing for college and those who are preparing to live in the community. These thirty-four schools have realized that it is the function of the school to serve the community by which it is maintained, that it is not the function of the school to catch the best of the offspring of the countryside and cast it into channels that will more or less effectually prevent its return to replenish the personnel of the countryside. These schools are endeavoring to offer the community a type of education which will dignify the occupation of farming in the eyes of the student, which will provide its pupils with a fund of facts relating to modern agriculture, an outlook on life in harmony with their surroundings, and a culture arising from a full sympathy with the things that are real in their everyday life.

If the school and the community are to work together in harmony, each must be necessary to the other. The school must do three things for its community: First, it must prepare some of the children of the community to enter higher institutions. Secondly, it must give the other pupils the best possible development for successful lives in the community. Thirdly, it must extend its influence to those who do not attend school and who have received a less complete education.

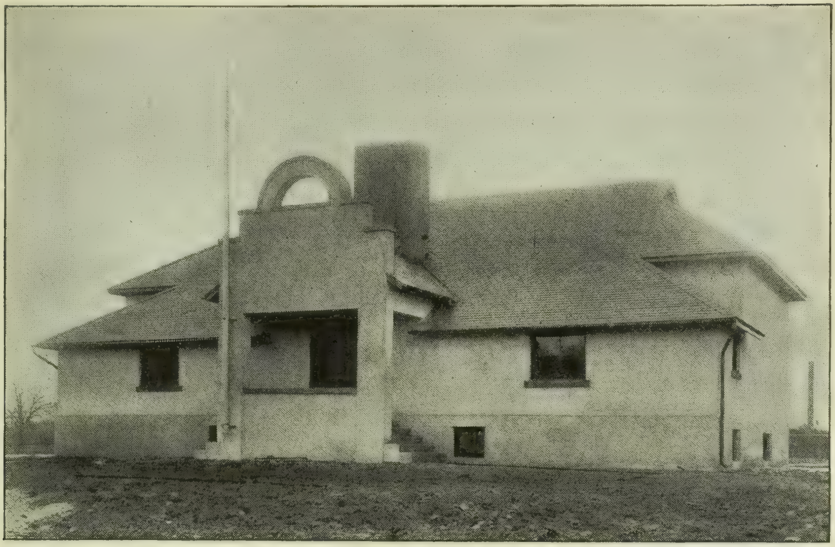


FIG. 96.— *A new rural school building in Chemung county*

The farmer has, in turn, an obligation to the high school. This obligation does not involve great expense or labor. It does involve a charitable spirit toward the agricultural school, an occasional word of suggestion, encouragement, and helpful criticism. It is for the farmer to cooperate with his neighbors and with the high school of agriculture to help improve

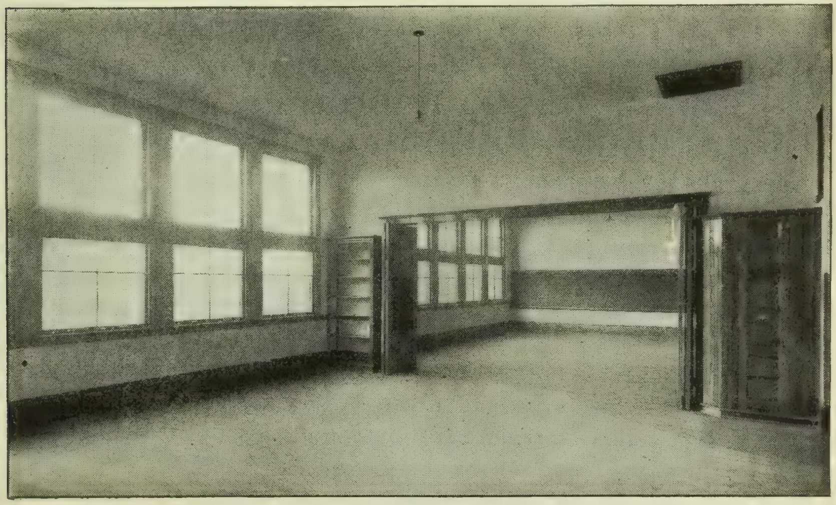


FIG. 97.— *The interior of the building*

the district school; to help establish organizations for the promotion of his own interests; to lend fields, buildings, and stock for the use of the school; to seek enlightenment from, and offer assistance to, the school — in short, to cooperate with the school in making life in the rural community as attractive and as worth while as life in town.

THE COUNTY AGENT AND THE RURAL SCHOOLS

LEWIS A. TOAN
(A county agent)

The purpose of the farm bureau is to assist the farmers of a county, wherever possible, in the solution of any problems arising on their farms or in their communities. It is the connecting link between the college and the experiment stations, and the farmer. Farm bureaus are usually supported by appropriations from the federal, state, and county governments, by local chambers of commerce, by railroads, and by farmers belonging to the local county farm bureau association. The director of the farm bureau is often called the county agent.

The opportunities for the county agent to be of service in the rural schools of a county are limited only by the time at his disposal. In the near future, wherever the farm bureaus are successful a specialist may be employed to work in cooperation with district school superintendents and teachers in developing this important line of work.

No man has a greater opportunity to become acquainted with the agricultural conditions of a section than a county agent. He knows the type of farming that is best adapted to the locality, and when he visits a school he can gain the interest of the boys and girls by discussing with them minor, everyday farm problems in which each one is interested. Good ideas or methods practiced in one school can be carried on to the next and made to fit that locality.

Few rural school-teachers, or teachers in the grades or high schools, have had the opportunity to learn much about elementary agriculture or nature study. If not acquired before they begin teaching, only a small proportion of them have the time or the inclination to study these subjects by themselves; then, too, there is a hesitancy in teaching subjects of which they know very little, and they sometimes fear the ridicule of both pupils and parents. The county agent can put each teacher in touch with sources of information, or he can visit the school, if time permits, and give short talks or demonstrations on topics of particular interest to the locality.

Boys and girls in our rural schools can be taught the value of seed selection. There are great opportunities to-day to improve our corn, potato, and grain crops by using better seed. Flowers, insects, animals, clovers, grasses, and many other outdoor things can be brought to the attention of the boys and girls by the county agent. His work will supplement the work of the teacher.

The county agent can work with the school superintendents in stimulating interest among the pupils and their parents in beautifying the school grounds. Suggestions from one section can be brought to another part of the county. Prizes may be awarded by granges or other organizations for the school that makes the greatest improvement in one year. The best rural school in a township may then compete for a county prize.

Because of his agricultural training and his opportunities for travel and acquaintance throughout the county, the county agent is in a position to cooperate with school-teachers and superintendents along all lines which will make the boy or the girl realize that farming is one of the noblest of occupations, one that requires brain as well as brawn. If he can quicken the powers of observation of the rural school children so that they will notice plants and animals and their habits, which had heretofore been passed by each day unnoticed; if he can impress on each boy and girl some of the underlying principles of agriculture, so that certain farm practices may be better understood—then the interest of the boys and girls will be aroused, work will be no longer drudgery, and the farmer will have gained a willing worker who is ready to remain on the farm.

FIG. 98.— *A rural school building on the Cornell University campus*

If the county agent can stimulate this interest in God's great out-of-doors, he has a place among the schools of the county and his efforts will not have been in vain.

RURAL SCHOOL LIFE AND THE COUNTRY GIRL'S RELATION TO IT

ANNA WILSON

What in particular, can the country girl do to assist in the training of the children in her community? This is the question that I am asked to consider in this paper.

First, I should say, keeping in mind the importance of the period spent in school, we should study the special needs of country children, supplementing that with anything in our own experience which we believe is worth passing on. Whatever our own success or failure has taught us, whatever there may have been in our environment which we now see actually hindered our development, whatever coarseness or injustice may have crossed our path to weaken our faith in the beautiful and the true, or whatever may have strengthened our best selves — we owe it to the children that they receive the benefit of our knowledge. It is the law of all life and growth that we acquire something from those who have gone before. This seems very trite, but let us remind ourselves in this connection that our personal characters are the direct reflectors of what we have assimilated from the great truths of the universe. Those things that we have found to be worth while we can hand down in no better way than by example, and we *must* incorporate those truths into our everyday lives if we expect to convince our young people of their worth. In youth fewer impressions are made on the mind, hence the indelibility with which they are stamped there. I shall never forget the day when our proverbial bad boy in the district school actually got a whipping that he did not deserve, and how disgusted the boys were because he finally gave way to tears. The heroism of a boy of twelve who at a Christmas entertainment tore a brand-new coat from his shoulders and smothered the flames which otherwise might have burned the Santa Claus of the evening, is as fresh in my mind as if it had happened yesterday. For me, it was a lesson in humility — the knowledge that among my comrades there might be some one braver and cooler-headed, less mindful of self, than I.

When we imagine ourselves children again, we have no trouble in thinking of various things to make children happy. Most of us " grown-ups " know how delightful kindergartens are, whether we have ever had the privilege of attending one or not. How the children love the graded lesson work in the Sunday schools! And in a children's library more plastic little lives are molded than we can realize. But, you say, how can we get this equipment introduced into the country? First, I would say, use to the utmost what you have at hand. God's whole out-of-doors is a kindergarten. The open field is the best place in the world for some games, if there is an older person along to guide and direct. As I remember, in the kindergartens I have visited, story-telling was a favorite part of the curriculum. If you have taught a Sunday-school class in the country,

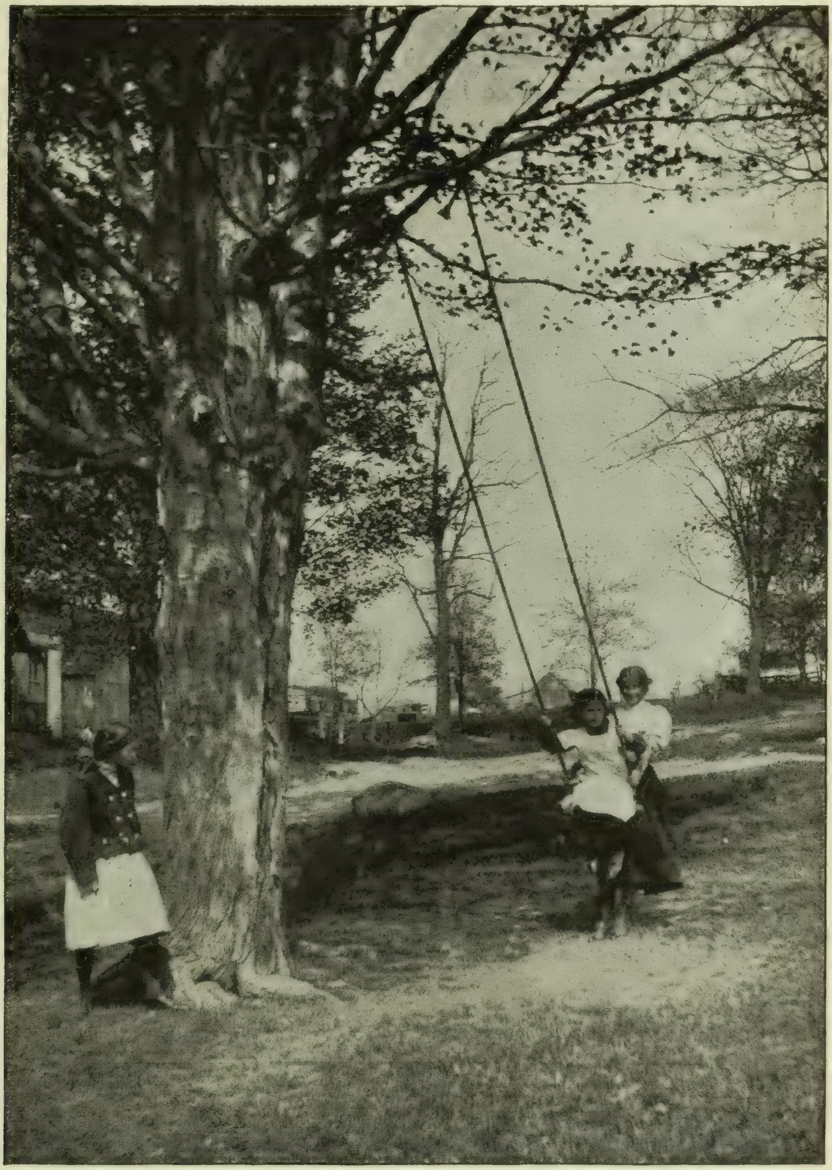


FIG. 99.— *Young women in the country can do much to direct the recreation of the boys and girls*

you know what a tremendous appeal the nature parables make to the child who plays every day near the growing corn and the wild lilies and the sprouting wheat. The biographical sketches in the Old Testament, as well as those in the New, never fail to interest children when sympathetically and simply told. Or perhaps some of you girls are fortunate enough to have added to your store of knowledge a bit of classical training. Can you not make those heroes of Troy and Rome — Iphigenia, Hector, Æneas — live in the minds and imaginations of the children, who have such faith in the abstract, God-given heroic? I am sure any little girl would like to become acquainted with those very human sisters, Antigone and Ismene — and do not be too hard on Ismene when you tell them the story. Try teaching a German folk song or lullaby to your little sister. She might be almost as interested as you in the life of Joan of Arc, or the wonderfully fantastic costumes which Marie Antoinette and her courtly friends wore.

FIG. 100.—*Wholesome outdoor pleasures are important in the education of young folk*

It may be that the dream of a children's library has long been cherished in your mind, but your school trustee tells you the district cannot afford it. There must be stone roads for automobiles and for hauling cabbage. Encourage the trustee to visit some children's library in your nearest city, where there are little chairs and tables and children's magazines, and a sympathetic librarian to help the little ones find the particular fairy stories or tales of bravery and invention that please them most, or the nature books written especially for children and accurately illustrated; and if this is not possible, tell him about such libraries and show him some good books for children. Perhaps you and friends can give a home-talent play, or devise some means of putting a hundred dollars or so into the trustee's hands for the first collection of books. This will be a valuable initial step.

Recreations are a part of the education of every child. There are some that are particularly well adapted to the country school and home. There are the folk dances, the sleighing parties in winter — we always had at least one in January, while our elders sat in state at the annual church meeting — the game of fox and geese, the sugar-camp revels, the pop-corn parties, the romps in the meadow in haying time, the day's hunt in the woods with father. The busy teacher will be very glad if you will teach your small brother to make toy ships, and intercede in his behalf for a baseball or a sled to keep him and his companions out of mischief during the noon and recess hours. Above all, cultivate in the children a love of fair play. I am told that is one of the greatest deficiencies of our country children.

There are many useful arts that we can teach the children. Little girls, I find, very easily learn to crochet, and such accomplishments are valuable when one grows up. If you were taught to crochet or knit or hem well when you were small, do you not find that the lessons learned then just for fun have proved helpful to you in the busier years when there is so little time for learning new things and when the learning is not so easy? Does it not pain you to see a girl of twelve or fourteen sitting in idleness with hands folded, because her mother is too busy to teach her daughter the simple tasks that would save so many steps in the day's work? A small child likes nothing better than to "help mother." And so, when a little girl comes to you with a request for a crocheted purse or a doll's dress, teach her how to make these things for herself. If she does not come to you, go to her.

Every child in the country should have knowledge of the out-of-doors. If a young girl in the community will become familiar with the birds, and the trees, and the wayside blossoms; with the story of the stones; with the neighboring waterways, and the plant and animal life in and about them — she can be of great value in helping the rural school-teacher to interest the boys and girls in nature, and this will be a most important contribution to education.

In my mother's garden two small boys, with the ostensible object of earning pin money, have picked up a surprising amount of knowledge about floriculture. Our agricultural extension schools are glad to cooperate with us in every way in diffusing knowledge regarding the processes of nature.

I have mentioned only a few of the ways in which we country girls can help the school-teacher and the busy parents. There are thousands of other ways in which we can cooperate with them in creating for country children the wholesome atmosphere, the love of work and of fair play, the courtesy toward elders and playmates, which shall help them to meet courageously and enthusiastically and successfully those years of early maturity on which so much of the happiness of later life depends. Do you underestimate your own ability or your own responsibility in the matter? What did Christ say when the disciples were startled and puzzled that he should even suggest feeding the hungry multitide? "How many loaves have ye?" Phillips Brooks preached a sermon on that text, and in his closing remarks he said, "I think, sometimes, of how, if the Lord had preached to men who were mostly farmers instead of shepherds, He would have made them another parable. Instead of the lost sheep on the mountains, He would have told of the lost seed on the barn floor. Instead of the love that sought the wanderer, and brought it to the fold, he would have wonderfully pictured the love that found the trampled grain, with all its power of life, and buried it in the rich ground. 'How many loaves have you?' It is the Lord's first question; and the hands of those who really want his help search their robes to see what they have hidden there. One brings his joy; another brings his pain; another brings his helpless desire; another brings his poor resolution. . . . It is a poor collection; only seven loaves, and a few little fishes; but it is enough. His blessing falls upon them, and they come back to the souls which gave them up to Him, multiplied into the means of healthy, holy, happy life."

FIG. 101.—*A nature-study trip*

NEIGHBORHOOD WORK

MARGARET PARISH

Although we live in an age when it is possible for us to obtain many advantages in education and recreation, can we honestly say to ourselves that we never envy the good times that our grandmothers had in their all-day visits, in their quilting parties, in their apple-paring and husking bees?

FIG. 102.— *Exhibitions at school are important. The grown folk should take an interest in them*

In these days many young women leave their homes for several years in order to obtain education and training. For various reasons, some do not return to their former homes. Many enter professions, others marry and help to establish homes in a new community. But still others return to their homes and find that already new neighbors await them. What is our attitude toward these new faces? Do we wish to mingle with them? Do we realize that there might be new friendships formed and old ones strengthened, and that a much happier feeling would exist in our community if we did our part in breaking the ice and in helping to form new ties? To be sure, many of our neighbors may not have had the advantages that some of us have been fortunate enough to have had. But if we help to establish a good library and to have a good club in our midst, we have the right to expect improvement, and in trying to help our neighbors we are sure to help ourselves.

The grange has its place and meets a certain need, but our homes will do more if they are used in the right way.

Can we feel that our life is complete if we do not know or wish to know our neighbors?

We should be up and doing. Too much time has been lost. To be sure, much that we would do we cannot accomplish. But wherever we live or whatever we do, nothing will give us greater satisfaction than the thought that we have tried to help life in our neighborhood.

Park says: " Life is the greatest art of all, and the master artist is the man who is living the beautiful life. We cannot all of us excel in the minor arts. But whether we like it or no, we are all artists in the art of arts, and we are producing either ugly or beautiful lives out of the materials at our command."

AGRICULTURAL CONTESTS

EDWARD M. TUTTLE

There is education for boys and girls in well-directed competitions. The struggle to obtain a product that excels; the ability to undertake a definite task and complete it; the satisfaction resulting from a finished product; the courage to be square and honest in doing the work; the self-control to succeed without vanity and to fail without despair — all are fundamental to the building of character. Persons who know children realize these things, but they also realize that very different and

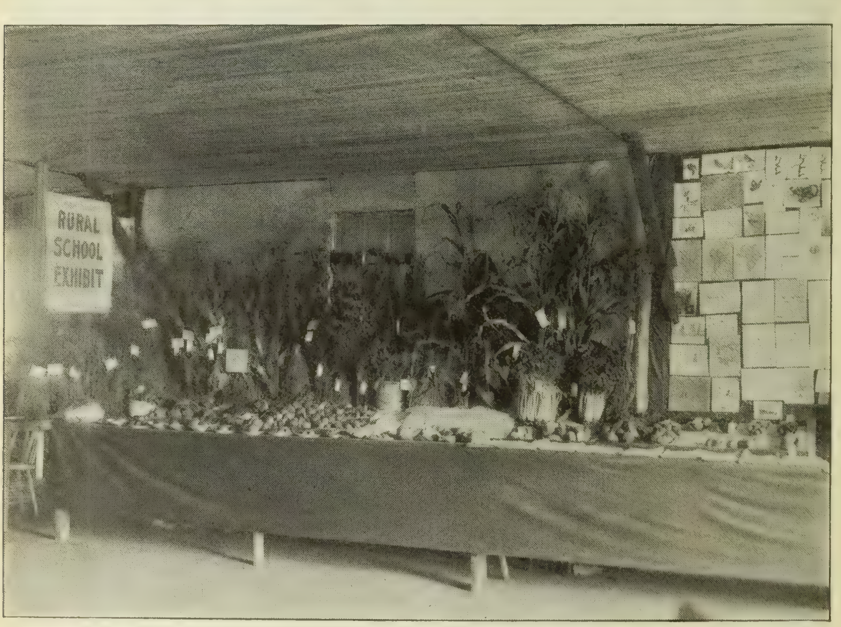


FIG. 103.— *A school exhibit at a fair*

most serious results may come when competitions among young folk are regarded as ends in themselves rather than as a means to the great end — training for mature life. In this lesson it may be well, therefore, to present a few considerations on this important subject.

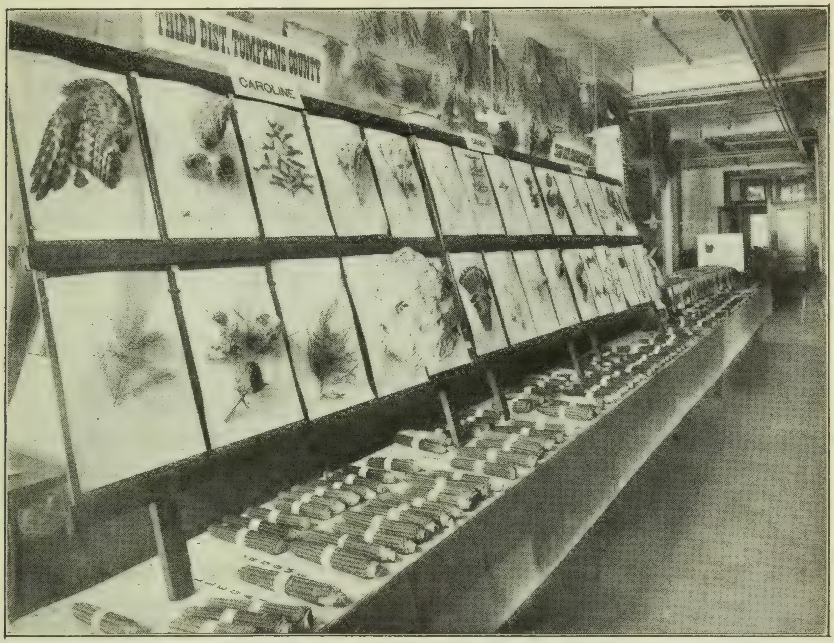


FIG. 104.— *An exhibit of rural school work at the State College of Agriculture*

In the rural districts boys and girls miss the element of strenuous competition with their fellows which children in crowded cities and villages experience daily. In order to supply this deficiency a movement has developed to organize contests along various lines pertaining to the farm and the farm home. The primary motive back of these contests is not economic — it is educational. Consequently, in New York State effort is being made to place the direction and the leadership of such contests in the hands of the established, organized, educational agency in the open country, which is represented by the district superintendent of rural schools.

What, then, should be the attitude of the farmers and the farmers' wives, the taxpayers, and all parents in the open country toward this movement? In the first place, they should realize its value as a factor in preparing children to take their places in the world of productive effort, which is a world of competition; they should realize its value in preparing them to meet with and appreciate their fellow men. In addition to its element of individual effort, every contest should include a group effort that will teach the spirit of cooperation. This may usually be worked out as an organized program at the close of the contest.

Secondly, the whole countryside should aid the district superintendent in organizing the contests on a sound basis. The movement should be strongly supported before it is started. Fifty successes may not be able to undo one failure.

Thirdly, the boys and girls should be encouraged to enter the contests. They will need an economic motive, even though the older folk know that the great value to them will not be economic, but rather educational. The prize that may be offered is not an economic motive, it is a reward of merit. Parents should agree to credit in some just way the work done by the child. Suppose, for example, that a half-acre corn-growing contest has been organized among the boys. The prizes are to be given for the best estimated net profits, together with the best ten ear samples of the product. The corn, however, remains. It is worth something to some one. The boy should be helped to receive a just value for his product. He should not give it away, nor should his father take it for more than it is worth. Or suppose the girls have a canning contest and prizes are given for the quality and the amount of work done. After the prizes are awarded, the canned goods still remain. They are economically valuable; they should have economic recognition. The mother or some friend needs them and is willing to pay a just price for them, no more, no less. In this way the economic motive can be supplied. The prize is a reward; the value is earned. Gradually in contests money prizes will be done away with, and the reward will represent the honor but will carry little intrinsic value.

In the fourth place, older folk should guard against those evils that may arise from misdirected competition. They should help the boy or the girl to be honorable and fair. They should particularly watch themselves, lest they, in their eagerness to help a favored son or daughter, introduce an element of dishonesty. The child should be encouraged and advised, but he or she must do the work prescribed without outside aid. It is fundamental training to carry out a set of rules to the letter.

Finally, agricultural contests are being organized in many districts in the State. Their success depends on their being understood and supported by the local community. Their value to boys and girls when wisely conducted is beyond estimate. It behooves all who believe in children, and in the men and women of the future whom they represent, to cooperate intelligently in this work.

EXTRACTS FROM LETTERS WRITTEN IN THE INTEREST OF RURAL EDUCATION

I have been asked to submit a few suggestions on ways in which a rural pastor may aid the rural school, and the following seem to me among the most important:

1. By interesting himself in the selection of a good trustee, one with a heart interest in the work of the school, who will cooperate with the teacher in efforts for its betterment.

2. By aiding in any way in his power in securing a good teacher, who is qualified by nature and training to govern a school and to awaken and inspire the youthful mind with high intellectual and moral ideals.

3. By standing for liberal salary and a long term of service when a good teacher is once obtained.

4. By interest in the operation of the school, shown in visits to the school and in words of appreciation of good work.

5. By showing, in intercourse with the people in their homes, an interest in the welfare of the school, and by encouraging parents to sustain and encourage the teacher in every possible way.

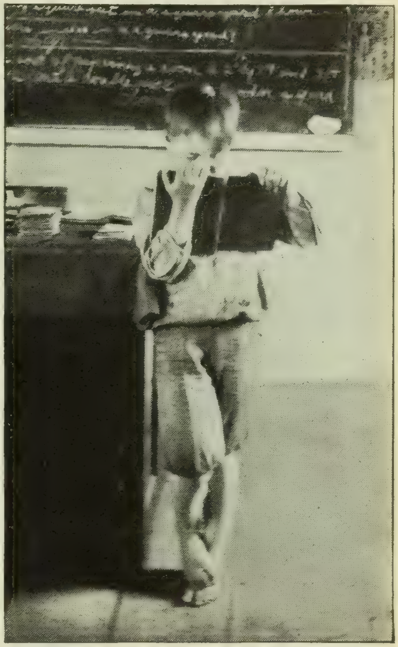


FIG 105.—*Hard at work*

6. By allowing free use of church buildings for school occasions when they will best serve the purpose.

7. By encouraging the pupils to look forward to advanced courses of study in high school and college.

8. By helping to popularize such new branches as nature study and elementary agriculture, explaining their educational and utilitarian value.

9. By promoting exhibitions at the school and at the State and county fairs and at Cornell during Farmers' Week, illustrating the enterprise of the school and the various phases of its work.

A. B. TEMPLE
(Rural pastor)
Seneca, New York

One of the first principles of the grange is education. How does it work?

1. Through the trustees. Every trustee who is a member of the order gives more attention to the school because he is a granger.

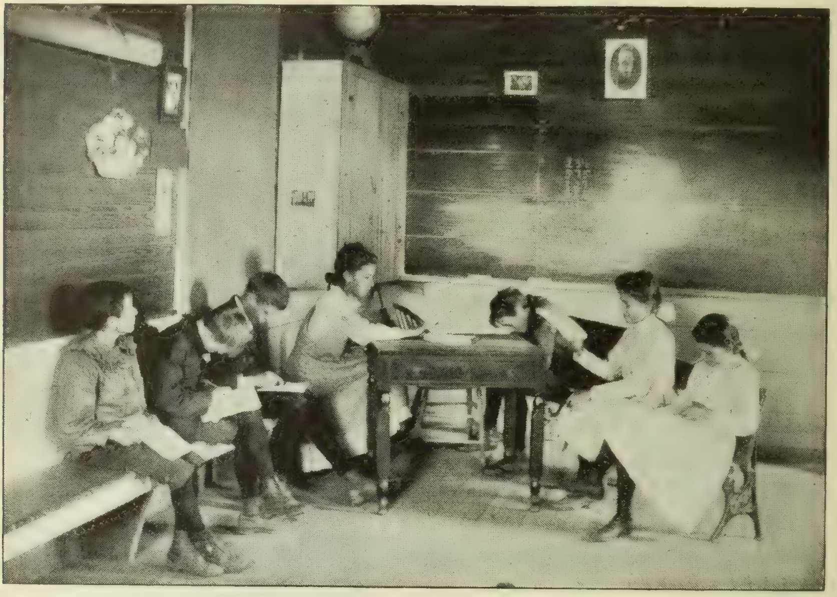


FIG. 106.— *Should we not do better than this?*

2. Through the teachers. Chautauqua County Grange raises a fund each year which is devoted to defraying the expenses of teachers taking a short course in agriculture, that they may do better work in teaching it in the district schools of the county.

3. Through the parents. Every parent who is a member of the grange and is called on to speak in public, finds out at once that an education is a fine acquisition and makes the determination to give the children every opportunity possible. Rarely, if ever, do you find grange parents keeping their children from school for financial gain.

4. The grange is eager to help the colleges in every way possible, and is the connecting link between them and the farm home.

5. It brings the legislators the very knowledge necessary to help in making an improvement in our educational laws, and is always watching the interests of the common schools. The State Grange, which has this work in charge, is ever on the watch that no laws injurious to the schools shall be passed if it is in their power to prevent them.

6. The grange meeting is the place where educators can meet the people of the rural homes and get in touch with the social conditions and needs of each locality.

S. J. LOWELL
(A granger)
Fredonia, New York

I think that we as mothers do not take the active interest in the rural school that we should, nor do we give the teachers the support, sympathy, and appreciation that is their due. I am sure the problems of discipline in the rural school to a large extent would be solved if parents knew by actual observation just how their children were responding to the teacher's efforts in their behalf. Too many parents are satisfied (or not satisfied, as the case may be) by seeing things through their children's eyes and from their viewpoint, and by so doing they seldom get the right perspective. Anything that would bring the mothers and the teachers into closer affiliation would be desirable.

FIG. 107.— *The teacher encourages the children. We should encourage the teacher*

I think that a cooking club composed of the teacher and her girls would be a very feasible plan. They could meet at the home of some mother who was efficient along some particular branch of the culinary art, and under her supervision have a practical demonstration. Then at some other home a lesson might be given in another branch of cooking. As a test of the practicability of the lessons, the club might provide lunch for the "last-day picnic," which has come to be a prevailing custom among rural schools.

A similar plan might be followed in giving the girls instruction in sewing and embroidery and other needlecraft. Of course there are children in all schools who receive all necessary training in their own homes, but there is always the incentive to more and better work when others are doing the same work, and the children who are not receiving home training have the advantage of the class work. At the close of the school year an exhibit might be held in the school building, under the supervision and direction of the teacher, at which time the children could display the samples of their skill.

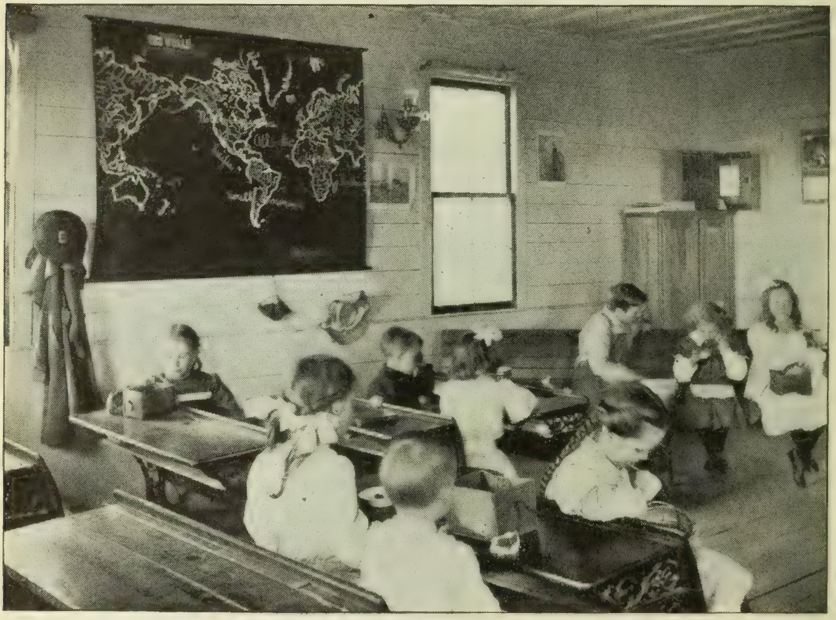


FIG. 108.— *One of the more modern school rooms*

Boys and girls alike would be interested in home economy in the matter of labor-saving devices, beautifying home grounds, and other things that would help in opening their eyes to all the natural resources around them. Any plan that has for its object the bringing together of parents and teacher to a more sympathetic understanding and appreciation of the needs of the children would be beneficial.

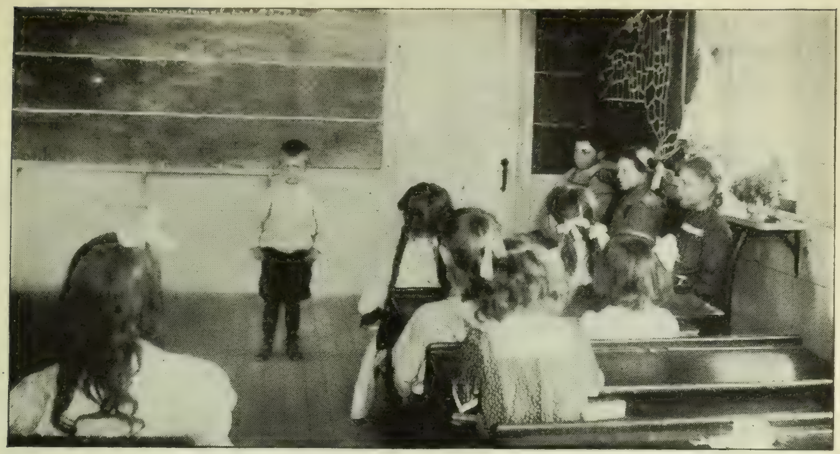


FIG. 109.— *"Speaking a piece." The parents should be present to hear it*

When we have helped the child to find himself and to realize the possibilities of his life when rightly directed, we shall have started a process of development that will make for education in its best sense and will not cease when the regular routine of school life is over.

I am fearful that I have not been very clear, definite, or helpful in my

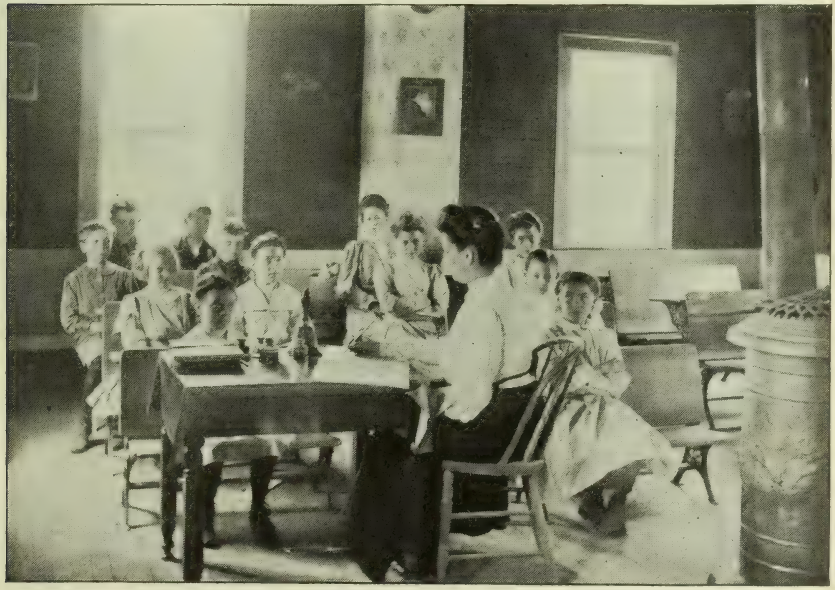


FIG. 110.— *What can we learn from this interior?*

remarks, and that you were led to expect more than I am able to give you; but, trusting that you may find some thought that may be helpful, I am,

Yours in the work for better rural schools,
MRS. GEORGE B. COMSTOCK
(A mother in a rural neighborhood)
Penn Yan, New York

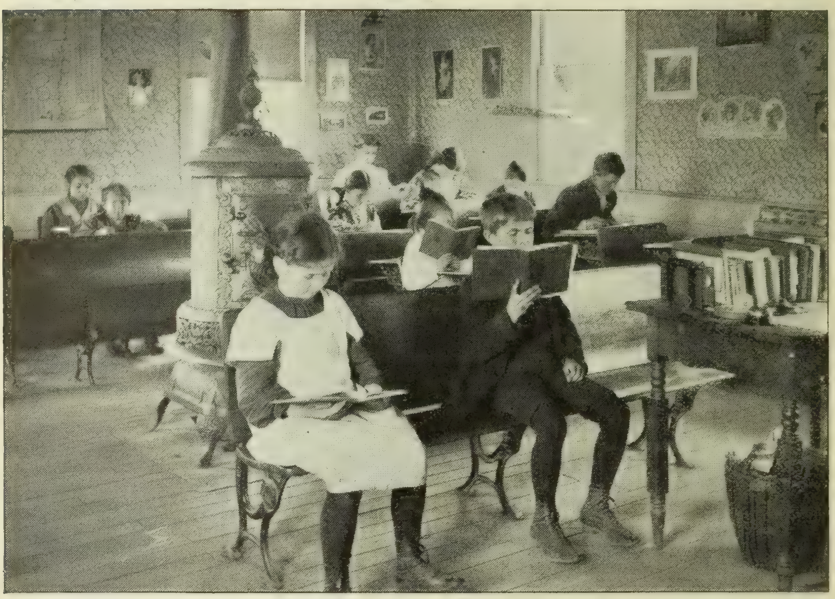


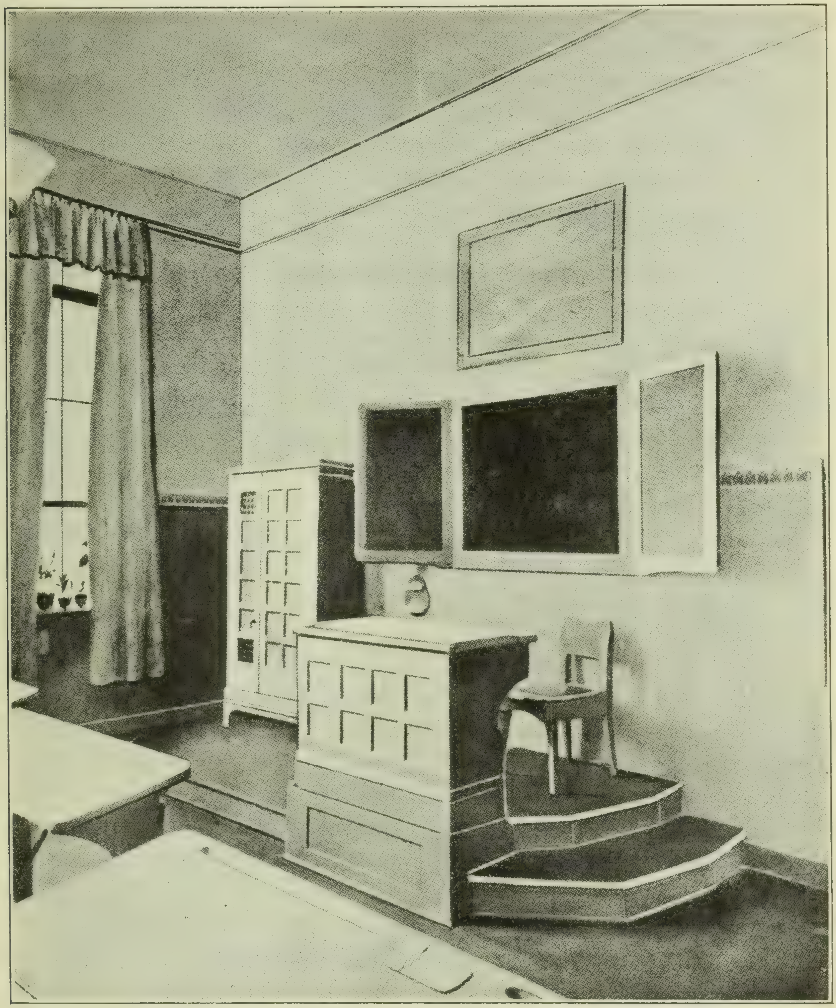
FIG. 111.— *This room might be made comfortable and attractive*

How can the local fair be of assistance to the rural school? A fair can help a school only when the pupils of the school have become interested in the fair and have a part in it.

The local fair society should offer prizes for exhibits of farm produce and manual-training work for the boys, and food products and needlework for the girls. These exhibits should be staged by schools something as the grange exhibits are at the State Fair. Cash prizes should be offered to the individual boy and girl, and either a cash prize or a diploma to the school making the best show.

The scope of the contest should be decided by the district superintendents and the authorities of the fair early in the winter, and the plan placed before the schools by the superintendents before spring. The contest should be open to the rural schools of the county, making the school the unit but also giving consideration to the individual exhibitions.

The pupils might be encouraged to attend the fair on a certain day, and then be divided into groups of one or more schools under the leadership of a competent person. The leader should, for a time not long enough to become irksome, conduct his or her group about the grounds and explain the different exhibits. This should be done in a rather informal way; the desire of the children should be followed to a large extent, but they should get the most out of what they wish to see.



FROM THE CATALOGUE OF VEREINIGTEN SCHULMÖDELFABRIKEN, STUTTGART, GERMANY

FIG. 112.—*A schoolroom in Germany. Note the dignity and restfulness of this interior*

These are only points, the details of which will have to be worked out under local conditions.

HAMLET WORKER
(Local fair officer)
Camillus, New York

You cannot have the most valuable rural school until all the people of the district are interested in the children and the school work, and generally they are not really interested unless they have some active part in it, something that they are directly responsible for.

Every man in a school district can do some one thing well. He may be a farmer or a mechanic; but, whoever he is, he will be glad to give instruction to the children if you do not require too much of his time. Every successful man is a busy man.

I think a young man in any school district can do a great amount of good if he will help the teacher of the school to get every man in the school district to do some one thing for the children. It may be to show them how to plant or graft a tree, how to take care of hens, how to do a piece of carpenter work, or how to do any one thing that he is successful in doing.

I have just been reading in our local paper how in some of the school districts the *men* were helping the teacher with the Christmas program, and that they were there to help carry it out.

Get everybody doing something.

GILBERT A. PROLE
(A young man in a rural district)
Batavia, New York

ACKNOWLEDGMENT

Figures 87, 99, 100, 105, 106, 107, 108, 109, 110, and 111 in this Reading-Course lesson are from photographs by Verne Morton.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

W. A. Stocking, Jr., *Acting Director* A. R. Mann, *General Editor*

COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 64 MAY 15, 1914 COUNTRY LIFE SERIES No. 1

THE RURAL SCHOOL AND THE COMMUNITY

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of bringing out the main points covered or of calling attention to related agricultural facts, practices, or methods. The College encourages an expression of opinion or a statement of experience by means of the questions asked. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if agricultural information is desired regarding personal or community problems or the subject studied.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT-GROWING, FARM CROPS, STOCK-FEEDING, VEGETABLE GARDENING, PLANT-BREEDING, COUNTRY LIFE. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. *Persons who wish to receive the other lessons in this series should therefore sign and return this discussion paper whether the questions are answered or not.* As an aid to students taking Reading-Courses, study clubs may be formed in various localities. References for advanced reading will be given on request. *The space below on this page is reserved for correspondence concerning Reading-Courses, and also for names and addresses of any persons likely to become interested on receipt of information.*

(*In answering questions, attach additional paper if needed and number the answers.*)

1. Have you considered how much the teaching of agriculture and natural history in the school would mean in dignifying the business of farming in the minds of boys and girls? What suggestions have you to make for encouraging such teaching? In what way might the farmers assist in giving instruction in agriculture in the rural school?

2. Have you considered the advantages and the disadvantages of a consolidated school, so that if you need to help in making a decision relating to this question in your own district you will be able to speak from a background of knowledge?

3. Is the rural school building in your district in good repair? Is it neat and attractive on the outside and in the interior? Has any provision been made to make the outbuildings sanitary?

4. What change is possible so that light may enter the building from the pupils' left, as they are seated? Are there shades that can be used in order to adjust the light? What provision has been made for ventilation? Can the windows be raised?

5. Have you a good teacher in your school? If so, what is done to encourage her to stay? Has she a good boarding-place? In what ways do the patrons of the school express appreciation of her good work? Has she ever been encouraged to close her school so as to attend an educational meeting, such as the New York State Teachers' Association, Farmers' Week at the New York State College of Agriculture, and the like?

6. How often do you visit the school? In your visits have you taken any message to the boys and girls that may be useful to them in their daily lives?

7. Has your grange ever provided money to send a rural teacher to summer school, in order that a direct message for better country-life teaching might reach your community? This has been done by some granges.

8. What organized effort is there in your community to help in directing the recreation and amusements of the boys and girls? Would it be possible for the men, women, and children in your district to unite in an organized effort to make the school premises suitable for educational purposes? If so, let us hear about your plans. A report of your endeavor will inspire others.

Name..

Address in full...

Date..

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VOL. III. No. 65 JUNE 15, 1914 FARM CROPS SERIES No. 3

MEADOWS IN NEW YORK

E. G. MONTGOMERY

The area of New York State is approximately 30,000,000 acres. Of this amount about one half is classed as improved land and the other half as unimproved, that is, land which is never cultivated and is in forest, rough pasture, or waste land.

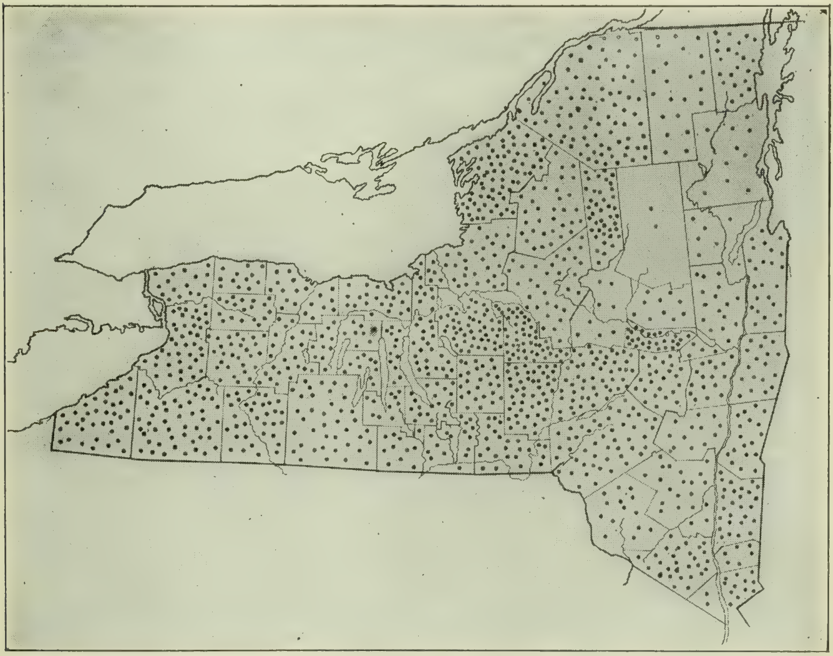

FIG. 113.— *Chart showing distribution of hay and forage in New York State. 1 dot to 5000 tons*

The improved lands of the State may be considered as of three kinds, namely: (1) pasture land, which differs from the unimproved pasture land in that it has been cultivated and sown at some time, and in fact is partly in regular rotation; (2) hay and forage lands, which occupy about one third of the improved land or one sixth of the State; (3) cultivated-crop lands, including all land used for grain crops and potatoes, which occupy about one tenth of the State. In round numbers the approximate area of the principal classes of land is as follows:

		Acres
Unimproved land		15,000,000
About two thirds forest		
The remainder, pasture and waste		
Improved land		15,000,000
Pasture	7,000,000	
Hay and forage	5,000,000	
Grain and miscellaneous crops	3,000,000	
Total		30,000,000

Approximately one third of the State is in forest, one third in pasture, and a little less than a third in farm crops.

According to the census of 1909 the leading crops in the State, in order of their value, were as follows:

Hay and forage	$77,360,000
Potatoes	20,339,000
Oats	17,977,000
Corn	11,439,000
Wheat	7,176,000
Dry beans	3,689,000
Buckwheat	3,588,000
Hops	2,598,000
Rye	1,578,000
Barley	1,316,000
	$147,060,000

From these statistics it is seen that hay and forage nearly equal in value all other farm crops.

In 1909 the principal hay and forage crops were valued as follows:

Timothy and clover, mixed	$42,530,142	
Timothy	16,944,241	
		$59,474,383
Clover alone		1,413,693
Coarse forage (corn fodder)		7,898,063
Alfalfa		1,182,246
Miscellaneous forage crops		7,392,260
Total		$77,360,645

Excluding coarse forage, which is mostly corn fodder, the hay crop is worth about $70,000,000, of which timothy and clover constitute six sevenths. There are no data that show the proportion of timothy in the mixed hay, but on the average there is more timothy than there is clover. It is therefore fairly safe to estimate that nearly two thirds of the hay value is timothy.

Red clover ranks next to timothy. Redtop is third in importance. In certain parts of the State — as, for example, in the Volusia hills of southern New York, especially where the land is wet or acid — it constitutes the principal grass on old meadows. It should be remembered, however, that redtop becomes important only where the land is not suited to grow timothy. Alfalfa-growing is rapidly increasing, having advanced from 5000 acres in 1899 to 35,000 acres in 1909. In time alfalfa is certain to become an important forage crop. Other forage crops grown to a limited extent are millets, salt hay, and grains cut green for hay.

Since timothy is the important hay grass of New York, the discussion here presented will apply chiefly to the timothy meadow.

CHARACTER OF NEW YORK STATE MEADOWS

For the ten years 1900 to 1909, the average yield of hay per acre in New York State was 1.22 ton. This small average yield indicates a short growth and a thin stand.

COMMON PRACTICE ON NEW YORK STATE MEADOWS

Practically all meadowland in New York State is seeded with a mixture of clover and timothy at the rate of about six to eight quarts of timothy and four to six quarts of clover an acre. In many places where red clover is failing to give good results, alsike clover is added at the rate of three pounds of alsike to five pounds of red clover. Redtop, which is seldom sown alone, is often added to the above mixture on wet lands or acid soils where timothy does not do well.

Some farmers consider it advisable to add redtop in any event, as it makes more " bottom " grass in the meadow and they believe that it increases the yield of hay. It is doubtful, however, whether this practice is advisable except on land where timothy is uncertain. Usually it is not desirable to add either alsike clover or redtop on land where timothy and red clover do well. On a large proportion of our hay land, however, red clover no longer succeeds in all parts of the field, owing generally to lack of lime. On such land it is well to mix in the alsike.

CONDITION OF OLD MEADOWS

Clover and timothy meadows are at their best for the first two years after sowing. Most of the red clover disappears during the first year, due to the ravages of the root-borer. In the second year and thereafter the crop will contain very little clover except where some seed has ripened.

Change goes on in the meadow from year to year, depending on the soil and on the care that it receives. When conditions are very favorable for timothy it will sometimes live indefinitely; in fact, timothy meadows are known which are fifty years old and are still doing well.

Ordinarily, certain weeds, as the daisy and the fleabane, and in most places redtop, come in. The rapidity with which these plants spread depends on how favorable the soil is kept for timothy. Proper manuring and fertilizing will often render a timothy field free from weeds for many years. This is demonstrated in the rotation plats at Cornell. In plats on which fertilizer is applied the hay will be almost free from weeds, while in unfertilized plats daisies and other weeds will usually be abundant within three years.

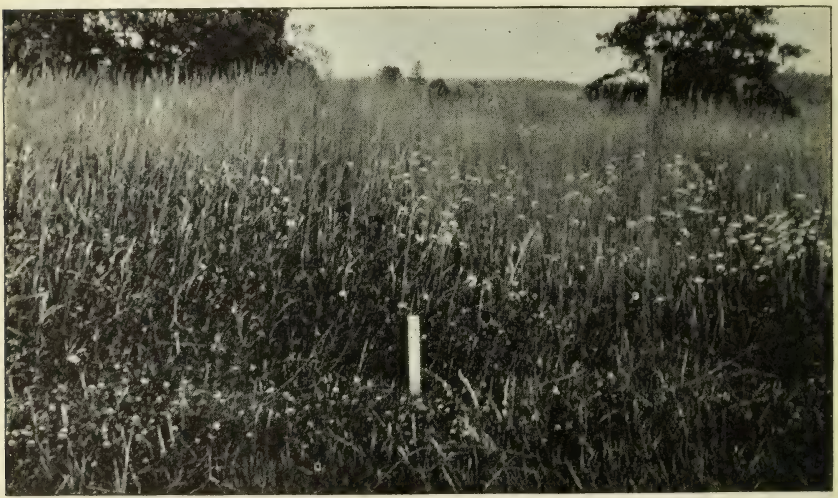

FIG. 114.— *The right-hand plat was not fertilized and is full of daisies; the plat on the left was fertilized and is practically free from weeds*

RELATIVE HAY VALUES

Clean timothy commands a premium on the market amounting on an average to $2 to $5 a ton. This premium is based, not so much on the comparative feeding value of pure timothy and of mixed hay, as on the fact that the quality of timothy is usually reliable. For the farmer who has young stock to maintain or cows to feed, mixed hay is the more valuable, provided the quality is good. It is probably the uncertain quality of clover-mixed hay more than any other cause that affects the market price.

DESCRIPTION OF HAY PLANTS

Timothy

Timothy is our principal hay plant for several reasons:

1. Seed may be produced cheaply.
2. A stand is easily obtained.
3. The quality is retained for a considerable time after the plant has reached full growth.

There are other grass plants that would make as good hay as timothy does; but no matter how good a hay plant may be, if it does not produce seed abundantly it can never be used for a cultivated hay plant. Timothy meets this requirement. As important a consideration as the production of abundant seed, however, is the ease with which good hay is obtained. Many grasses — such as orchard grass, for example — must be cut at just the right time or they quickly lose quality. While timothy is best about one week after blossoming, it will make good hay for a period of at least three weeks thereafter. This is important, for the farmer cannot always adjust his work so as to cut all his hay crop at a certain time.

Soil.— In New York State timothy does best on rather heavy loam or clay soils. Very sandy soil is not considered good, probably because of its low fertility. Timothy does not do well on the stony Volusia silt or the clay hills of southern New York, owing partly to low fertility but perhaps more to the general lack of lime. On these hills lime will often improve the soil more than will the addition of fertilizer.

Climate.— South of the Ohio River, timothy summerkills because of the long-continued hot weather, which is most unfavorable for its development. In dry pastures, also, on south or west exposures, timothy readily summerkills in hot seasons. A rather humid and cool climate is best for a good growth of leaves. Timothy hay from dry regions is lacking in leafiness. A cool and humid climate combined with a cool and moist soil furnishes the best conditions. These conditions are fairly well met in New York State.

Red clover

While there are many kinds of clover, none compares in yield with, or surpasses in quality, red clover. This clover is recognized by botanists as a weak perennial that in certain mild climates lives for several years. In New York it is regarded as a biennial, owing to the fact that our winters are severe enough to kill many of the plants after the second year, and probably more especially because the clover root-borer infests and kills practically every plant by the end of the second year.

When red clover in small percentage is found for many years in a meadow, it is due to two causes: (1) most clover seed contains some "hard" seed, which does not germinate until the second year; (2) in many cases some plants go to seed each year, thus keeping up a thin stand.

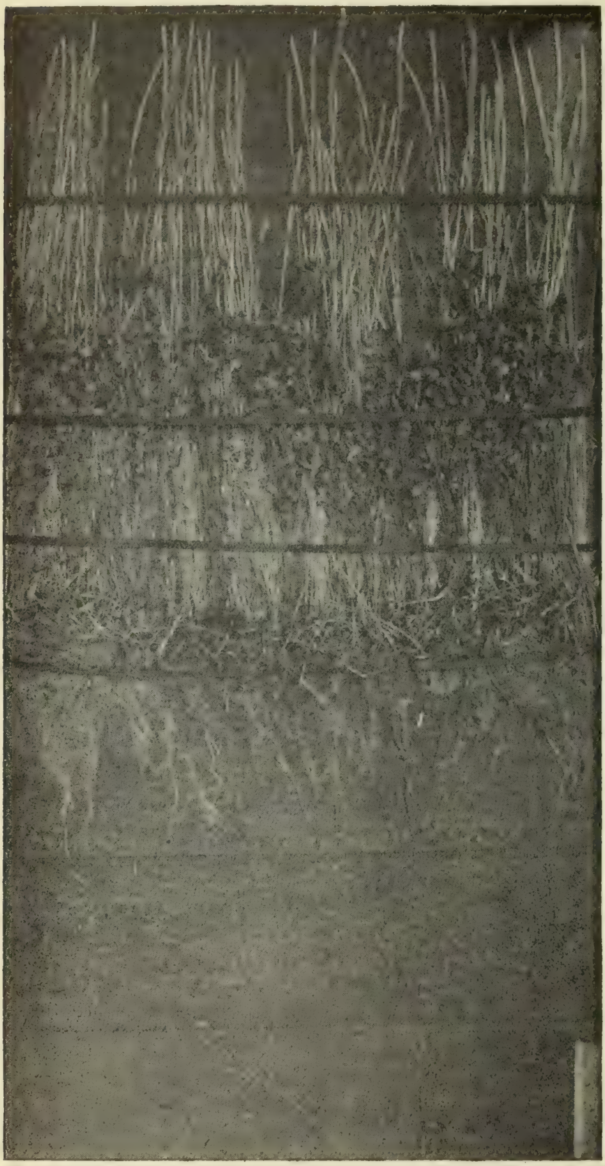

FIG. 115.— *Clover and timothy plants, showing roots. The clover roots are long, while the timothy roots are mostly near the surface*

Red clover has almost the same soil and climate requirements, and about the same range of distribution, as timothy has. It differs principally in that it has a much higher lime requirement. While timothy will not do well on an acid soil, yet it does do well in locations where lime would have to be applied in order to grow clover.

Clover sickness.— "Clover sickness" is a term often applied to the condition of fields where clover grew at one time but has ceased to do well. In this State it is very common to find land on which clover grew readily years ago but on which little or no clover can be grown now. While there may be several minor causes contributing to this condition, the principal causes seem to be a lack of lime and humus in the soil. The lime, which was low in the beginning, has leached out; at the same time the organic matter has been destroyed by heavy cropping and erosion, and none has been returned. A ton of lime to an acre will ordinarily restore clover, but manure may also need to be added before a good crop can be obtained.

Clover and timothy roots.— The roots of clover penetrate much deeper than do those of timothy. On heavy clay soil timothy roots are largely limited to eight inches in depth, while the large clover roots penetrate to a depth of at least two feet. In this way timothy and clover can grow on the same soil without much competition, for their roots do not occupy the same stratum of soil.

Effect of clover on timothy.— It has been demonstrated that, when grown with timothy, a leguminous plant such as clover, which gathers nitrogen from the air, benefits the timothy in two ways: first, the growth of timothy is larger; secondly, the timothy is better food pound for pound, since it is richer in nitrogen compounds.

Alsike clover

Alsike will not yield so heavily as will red clover, even when both are grown under favorable conditions. It differs from red clover in one important respect: it will grow on land that contains more acid or is wetter than the land on which red clover will grow. For many years after land has ceased to grow red clover owing to the decrease of lime in the soil, alsike will do fairly well. It will also grow on wet land that is subjected to overflow from streams. Alsike does best on a limestone soil and responds to applications of lime as quickly as red clover does, but it will endure decrease in lime much longer than red clover will. This makes alsike a valuable plant to assist in building up soils that lack lime.

Mixing red clover and alsike.— On most of the clay soils outside the limestone regions, alsike should be mixed with red clover in seeding in order to insure a good stand of clover in all parts of the field. The usual mixture is three pounds of alsike to five pounds of red clover.

Redtop

Redtop bears about the same relation to timothy that alsike does to red clover, in that it grows on lands that are more acid and wetter than good timothy soils. In fact, redtop appears to have some preference for this type of soil, coming to its best growth on land that is not well adapted to the growth of timothy. Where timothy does well, redtop will not compete with it, but on the Volusia hills native redtop readily takes possession of the old meadows. Redtop should never be sown on good timothy land, but, like alsike, it should be sown as a part of every mixture on land that is not well adapted to timothy.

Summary

From the foregoing discussion it will be seen that the four principal hay plants may be ranked in the following order in respect to their lime and moisture requirements:

Red clover, which must have lime soil that is not too wet.

Timothy, which requires less lime than red clover does but which is not suited to an acid soil, and will grow on wetter soil.

Alsike, which has about the same requirements as timothy but will grow on more acid soil.

Redtop, which will grow on wet and acid soil.

MEADOW MIXTURES

The following tables give the kinds of seed and the amount for each acre recommended for a number of typical situations:

On good timothy and clover land, use:	
Timothy	15 pounds
Red clover	10 pounds
When red clover is uncertain or does not give a uniform stand, use:	
Timothy	15 pounds
Red clover	5 pounds
Alsike	3 pounds
When neither timothy nor red clover gives uniform results and the land is wet, use:	
Timothy	10 pounds
Redtop	5 pounds
Red clover	5 pounds
Alsike	3 pounds
On land both acid and wet, use:	
Redtop	10 pounds
Alsike	6 pounds

Since pure timothy is the most valuable market hay, constant effort should be made to put the land in good condition for timothy production by the use of lime and manure, and by drainage wherever it is practical.

Seeding meadows

In seeding meadows the principal consideration is to secure a strong, uniform stand of the desired grasses and clovers in the right proportion, without weeds or thin spots. The degree of skill required in order to obtain the desired result depends on how favorable the soil conditions are. On the best hay land it means merely sowing timothy with wheat or rye in fall and adding clover in spring. With less favorable natural conditions it may require several years of skillful management in order to secure satisfactory meadows.

Seeding alone.— Whenever it is difficult to obtain a good stand of hay, owing to dry weather or poor soil, grass and clover should be sown

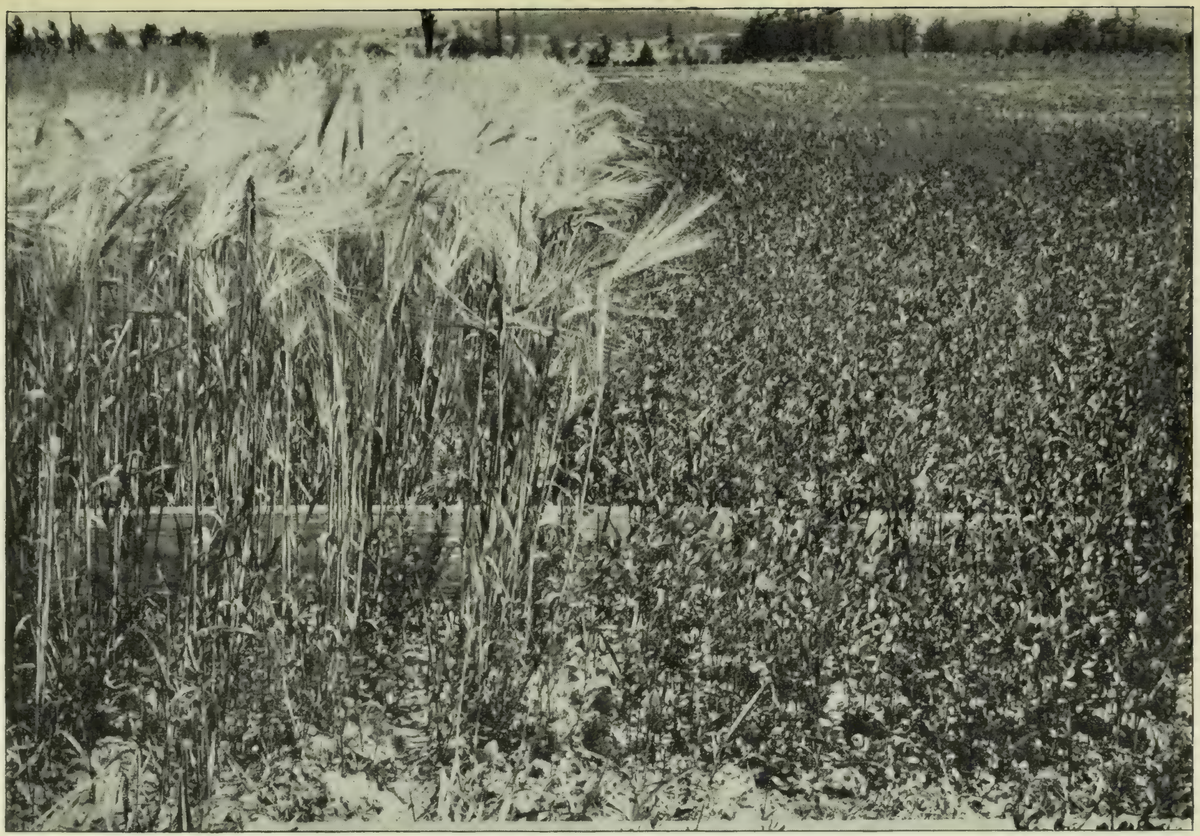

FIG. 116.— *Relative growth of alfalfa when sown with barley and when sown alone. An 8-inch board is shown in the foreground. Where no nurse crop is grown, the growth of alfalfa covers this board. Plats of the New York State College of Agriculture, 1913*

alone. In that case the grasses should be sown alone in August and the clovers in the following spring. By this method a two-thirds crop of grass might be harvested the first summer, and in many cases this would be as valuable as a grain crop.

Seeding with nurse crops.— In New York, however, conditions are very favorable for sowing with a nurse crop, and with care a good stand is usually obtained. The plan works in well with general farming methods, for most farmers desire to grow some grain and they need the straw. Wherever hay is an important crop, as it is on most New York farms, a poor or uneven seeding should not be risked for the sake of a good grain crop, since the seeding must stay down for several years and loss from poor seeding may extend over the whole period. In general, nurse crops should be sown thin; two bushels of oats or barley and one bushel of wheat is enough. If the land is poor or the season dry, the grass seeding will be correspondingly better as the amount of seed for the nurse crop is decreased.

Covering grass and clover seeds.— Since good seedings are often obtained by scattering the grass seed on the loose surface after grain is sown, many persons do not consider it important to cover grass and clover seed. On heavy clay soils covering is not so important, although generally the seeding should be rolled. It may be accepted as a rule, however, that the lighter and more porous the soil is, the more important it is to cover the seed. On open, porous soils it is advisable to cover it one to two inches deep; the depth of covering should be decreased as the soil becomes heavier. This applies to both grass and clover sown with spring grain.

If clover is sown in spring on fall wheat and the land is clay, it is usually satisfactory to sow without covering when the surface first begins to thaw, and to depend on alternate freezing and thawing to cover sufficiently. On lighter and dry soils the clover seed should be covered and rolled. The covering can be accomplished by dragging with a peg-tooth harrow or a weeder, or by going directly on the field with a grass-seed drill. Afterwards the field should be rolled. With care neither wheat nor grass will be injured.

CARE OF MEADOWS

The scientific care of meadows has never been developed in this State. Manure and fertilizer are often applied to other crops, but seldom to hay land. With the possible exception of potatoes, there is probably no crop that gives a return for manure or fertilizer equal to that realized from the hay crop.

Weeds

Weeds make up too large a percentage of the hay harvested in this State. " Daisy hay " is not uncommon; large fields are cut in which there are more daisies than there is grass. The best way to combat weeds in hay land is to make conditions favorable for grass. (Fig. 117.)

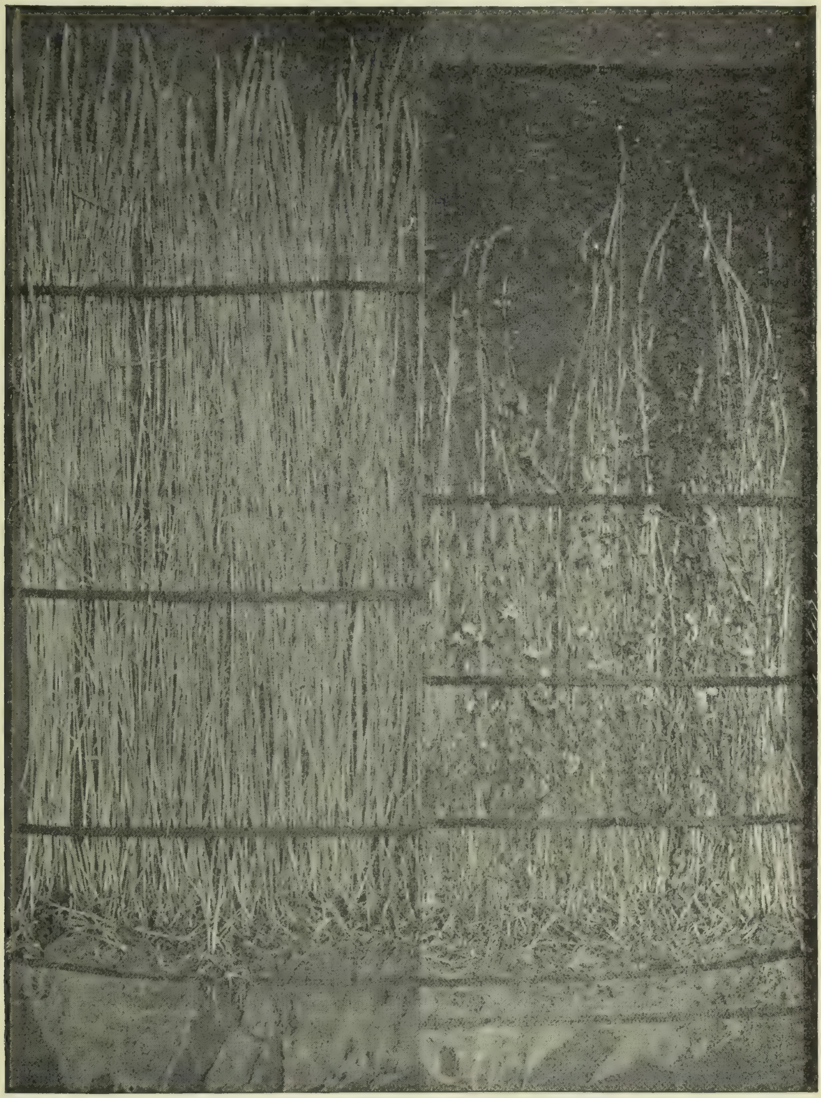

FIG. 117.— *On the right is shown a sample of hay from an unfertilized plat; note the high percentage of daisies and other weeds. On the left is a fair sample from a plat on which manure or fertilizer was applied*

Even daisies will not be much in evidence on good grassland. The fertilized plats maintained by the Department of Soil Technology at Cornell

University yield practically pure timothy; while the unfertilized plats, by the second or third year, contain a high percentage of daisies and other weeds.

Fertilizers for timothy

In a recent bulletin[1] of the College of Agriculture there have been published the results of applying fertilizers to timothy in a six-years rotation consisting of hay for three years followed by corn, oats, and wheat. The experiments have run for nine years, with the land in hay the first three and the last three years. The results practically show an average return of $1.70 for each dollar invested in fertilizer when all the hay harvested is estimated at $12 a ton. This does not include the increase from grain crops following, which is at least equal in value to the increase in the hay crop. The hay from fertilized plats is almost pure timothy, however, while the hay from unfertilized plats contains many weeds. This would make a difference of $2 to $5 a ton in the market value of the hay. Furthermore, it requires only about two fifths of an acre to grow a ton on the fertilized plats, while at least four fifths of an acre is required to grow a ton of hay without fertilizer. Thus the land rent for each ton on these plats is doubled. All things considered, about $2 has been returned on these plats for each dollar invested.

Fertilizing on old meadows.— In 1910 the University acquired a six-acre hay field which had been cut for three years. (Fig. 118.) No record of the hay yield had been kept previous to purchase, but the owner estimated the yield at about one and one fourth ton an acre the previous year. From comparison with similar fields, this may be taken as an average yield for such land after three years in hay. Beginning with the spring of 1910, this field has been fertilized with approximately the following dressing on each acre: 200 pounds sodium nitrate, 100 pounds acid phosphate, and 50 pounds muriate of potash. This top-dressing is equivalent to 350 pounds of a 9 : 4 : 7 fertilizer and costs between $5 and $6 an acre. The hay yields per acre for the past four years have been as follows:

1910	3.34 tons
1911	2.62 tons
1912	3.00 tons
1913	2.86 tons
Average	2.96 tons

Cooperative tests with farmers.— In the years 1908 and 1909, Professor G. F. Warren, of the New York State College of Agriculture, conducted cooperative tests with about forty farmers for the purpose of comparing several fertilizer experiments. Three different fertilizer mixtures were used and each gave fairly good results. An average return varying from \$1.50 to \$1.65 for each dollar invested in fertilizer was realized. As in the other experiments, the quality of hay was better and the land rental for each ton was smaller on the fertilized land.

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[1] Cornell University Agricultural Experiment Station Bulletin 339.

It should be remembered, however, that the foregoing is an average run. Not all fields taken by chance will respond to fertilizing. Fields with a thin stand of grass or those that are deficient in lime may respond very little to such treatment.

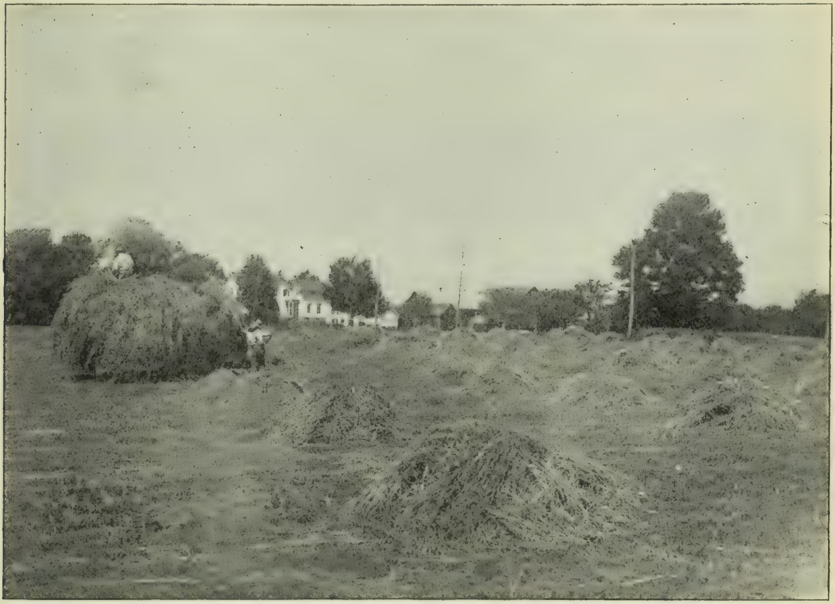

FIG. 118.— *The old meadow described on page* 2148, *showing the hay crop in 1910, the first year it was fertilized. Yield of hay, 3.34 tons per acre, with an average of nearly 3 tons for four years*

Kind of fertilizer to be used.— The results of investigation[2] from this station show that nitrogen is the most important element in fertilizing timothy on the heavy Dunkirk clay land, with potash and phosphate, respectively, ranking next. The results show also that two of these elements combined are better than one, and that complete fertilizer is the most profitable of all. This conclusion bears out general experiences.

For several years the following mixture has been recommended as a basis by the New York State College of Agriculture:

200 pounds sodium nitrate
100 pounds acid phosphate
50 pounds muriate of potash

This amount is recommended for an acre on heavy clay land. Experience has shown that it is not desirable to make so heavy an application of sodium nitrate on light soil or on sandy loam, since the timothy on such land is very likely to fire if the weather is dry. For sandy loam about one half of the above-mentioned quantities is recommended. Every farmer should experiment for himself in order to determine the most profitable rate for his own land.

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[2] Cornell University Agricultural Experiment Station Bulletin 339.

Manure for meadows

On meadow lands well-rotted manure gives better results than does the best fertilizer mixture. When such manure has been applied at a cost of $1.50 a ton, it has proved more profitable than has fertilizer.

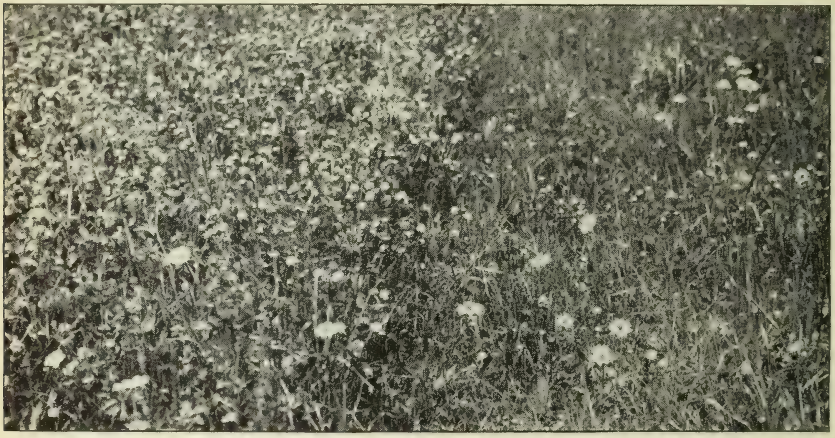

FIG. 119.— *Effect of lime on the growth of clover. Both the limed and the unlimed plats were sown to clover, but very little clover grew without lime*

Residual effects of manure and fertilizer.— Furthermore, it has been shown that the residual effect of the manure applied to the hay land gives about as large increases on the grain crops following as though the manure had been applied directly to these crops. A double benefit is therefore derived in the increased yield of hay and in the crops following. The foregoing statement regarding the residual effect of manure holds good for fertilizer also. The reason why this residual effect is so large is not fully understood. One explanation is that the large root growth stimulated in timothy as a result of the treatment leaves a much greater store of organic matter in the soil. By referring to Fig. 117 it will be seen that the timothy sod from fertilized plats left much more root and stubble than did that from the unfertilized plat.

Lime for timothy and clover

While lime is recognized as important for clover, it is not so generally known that timothy also responds to lime on much of our soil. In fact, on rather acid soils it has been found to give more response to lime than to the best fertilizer. If soil is very deficient in lime, there is no use in applying fertilizer until lime has been added.

Wherever the hay land is in regular rotation with other crops, it is very important to grow clover with timothy. This can be accomplished only when sufficient lime is present. A good illustration is shown in Fig. 119. The experiment was conducted in a Volusia clay soil that was decidedly acid. When the land was first cleared, according to the statement of the owner, clover was grown easily, but for at least twenty-five years it had not been possible to raise this crop. In the experiment lime was added on strips of land a rod wide, and, without sowing, a good stand of alsike clover came in where the lime was added. When a mixture of three clovers and five grasses was sown across the plats, all clovers and grasses did well where lime was added, but very little clover grew without lime and the grasses were poor. The timothy also was much better on limed plats. The relative yield of hay is given below and is illustrated in Fig. 120:

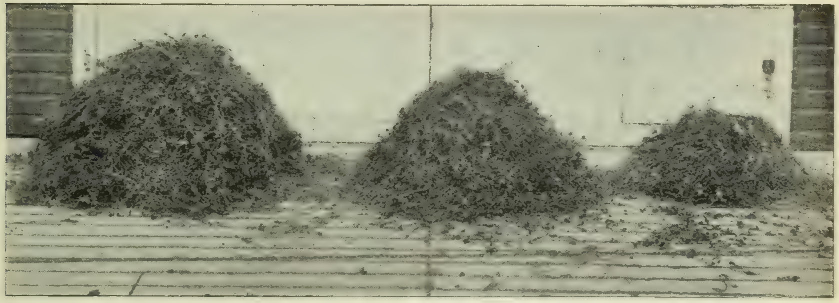
Plat 1 Plat 2 Plat 3

FIG. 120.— *Relative yields of hay from a heavy clay hill under different treatments. Plat 1, lime 2000 pounds, manure 8 tons, per acre; plat 2, lime 1000 pounds per acre; Plat 3, no lime nor manure*

Treatment	Yield of cured hay per acre (tons)
Check, no lime used	1.34
1,000 pounds lime per acre	2.51
2,000 pounds lime per acre 8 tons manure per acre	3.63

Rules for applying fertilizers to old meadows

In order to improve old meadows, the rules to be observed may be stated as follows:

1. See that the land has sufficient lime to grow good grass if fertilized.
2. See that there is a stand of timothy. There is no use in applying manure or fertilizer unless there is a reasonable stand of timothy roots. Fertilizing weeds will not give timothy hay.
3. Profitable results cannot be expected on poor land. Experience has shown that it will seldom pay to apply manure or fertilizer to hay land that under ordinary conditions will not produce at least one ton of timothy an acre. Such land should first be improved by growing cultivated crops, such as buckwheat, potatoes, or rye, by using barnyard manure, and by plowing under green crops.

Time of year to apply fertilizer.— The fertilizers recommended are all soluble and should be applied in spring, during early growth. If applied earlier than this, a heavy rain is very likely to wash away much of the soluble fertilizer. For best results the application should be made with a drill or a fertilizer spreader in order to insure uniform application. Usually the whole amount should be applied at one time.

Time to apply manure.— Perhaps the best time to apply manure is in late summer, after the hay crop is cut. This is not always convenient, for many farmers desire to haul the manure as it is made during fall and winter. This practice will be satisfactory and will give almost as good results.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

W. A. STOCKING, Jr., *Acting Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 66 JUNE 15, 1914 **FARM CROPS SERIES No. 3**

MEADOWS IN NEW YORK

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of bringing out the main points covered or of calling attention to related agricultural facts, practices, or methods. The College encourages an expression of opinion or a statement of experience by means of the questions asked. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if agricultural information is desired regarding personal or community problems or the subject studied.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT-GROWING, FARM CROPS, STOCK-FEEDING, VEGETABLE GARDENING, PLANT-BREEDING, COUNTRY LIFE. The first lesson in each series desired is sent on enrollment and subsequent lessons are sent, one at a time, on the return of discussion papers. *Persons who wish to receive the other lessons in this series should therefore sign and return this discussion paper whether the questions are answered or not.* As an aid to students taking Reading-Courses, study clubs may be formed in various localities. References for advanced reading will be given on request. *The space below on this page is reserved for correspondence concerning Reading-Course work, and also for names and addresses of any persons likely to become interested on receipt of information.*

(In answering questions, attach additional paper if needed and number the answers.)

1. In New York, why is the hay crop of so much importance as compared with grain crops?

2. Is the percentage of land in hay increasing or decreasing as compared with the percentage twenty or thirty years ago? Compare also the percentage of land in cultivated crops. Can you give reasons for the change?

3. Do you use fertilizer on hay, wheat, or potatoes? To which crop is the farmyard manure commonly applied? Where is the best place to apply it in the rotation?

4. Do the following crops grow well without lime: red clover, timothy, alsike clover, redtop? How can you tell, by observing the crops, whether or not your land requires lime?

5. If red clover does not grow well on your farm now, did it grow well twenty-five or thirty years ago? How can you make clover grow now?

6. How long do you expect red clover to live? alsike? timothy? redtop? What are the principal causes of short life?

7. Has any success been attained with other grasses, such as orchard grass, rye grass, meadow fescue, blue grass, or tall meadow oat grass?

8. If fertilizer has been tried, what increase has been obtained? Is a beneficial effect seen on the crop following? Answer the same questions for barnyard manure.

9. Under what conditions does it pay to fertilize a meadow?

10. Describe your soil. Is it stony, sandy, loamy, or heavy clay, and is it well drained or wet? What is needed in order to make it good hay land?

Name ....

Address in full ....

Date ....

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VOL. III. No. 68 JULY 15, 1914 PLANT-BREEDING SERIES No. 3

IMPROVING THE POTATO CROP BY SELECTION [1]

C. H. MYERS

In a previous Reading-Course lesson [2] the factors of environment and heredity were discussed in a general way in regard to their relation to crop production. The two methods of breeding, hybridization and selection, were discussed in some detail, as were the fundamental principles underlying these methods. In the present lesson, therefore, these points will not be taken up except in their direct application to the improvement of the potato crop.

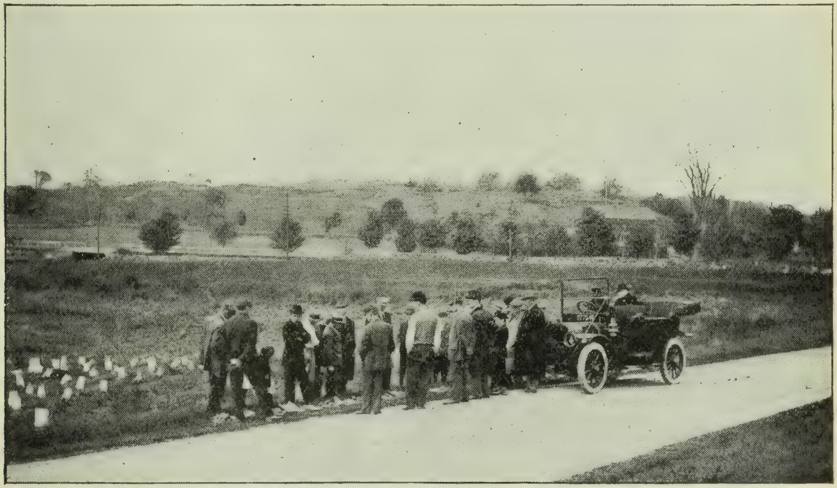

FIG. 121.— *A field meeting at a potato-breeding plat in Westchester county*

The potato is especially susceptible to its environment, and responds readily to any change that takes place in this important factor. Indeed, some writers are of the opinion that perhaps no other crop will pay so well for care and attention bestowed on it. But it is with the application of the factor of heredity that this lesson deals. And here, too, we may say that the potato responds readily to care and attention.

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[1] Paper No. 48, Department of Plant-Breeding, Cornell University, Ithaca, New York.

[2] The Cornell Reading-Courses, Lesson for the Farm, Vol. II, No. 38.

HYBRIDIZATION

In the breeding of potatoes, both the method of hybridization and that of selection may be employed. The former method, however, is not of particular use to the busy practical grower. It involves considerable time and labor for the amount of improvement that may be accomplished. Of course it is true that a large number, if not a majority, of our varieties of potatoes have been produced by selections from seedlings.

Probably every one has observed potato balls. These are due either to accidental or to artificial hybridization. When seed (Fig. 122) from such a seed ball is planted, a large number of varieties may be produced (Fig. 123). Some of these may be worthy of propagation, while many others will not. In any case, usually two to four years are required before potato seedlings reach sufficient development to show what their merits are. In the same length of time, the practical grower can accomplish much more by straight selection.

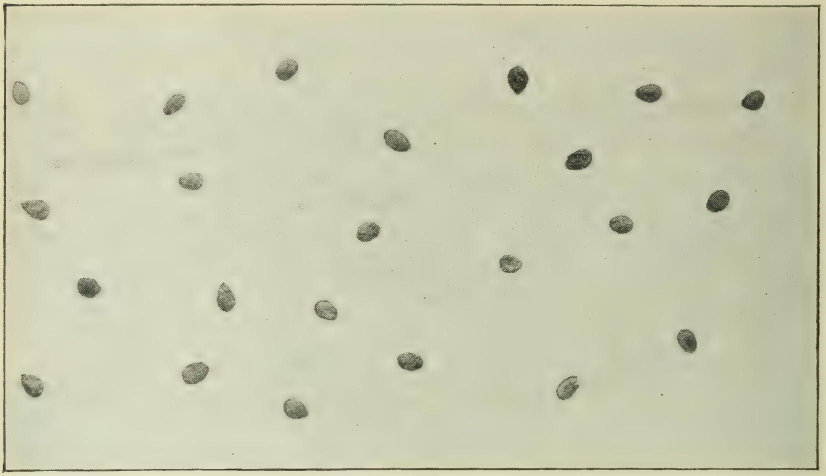

FIG. 122.— *Potato seed. Magnified two times*

Another objection to the method of hybridization is that, apparently, many of our varieties of potatoes have lost their power to produce seed balls, except on rare occasions. One reason advanced for this — and probably the most plausible one — is that plants which are propagated vegetatively (by cuttings) for any period of time gradually lose their power to produce seed. This may be especially true in the case of the potato, in which the fruit is not the part that is used for food.

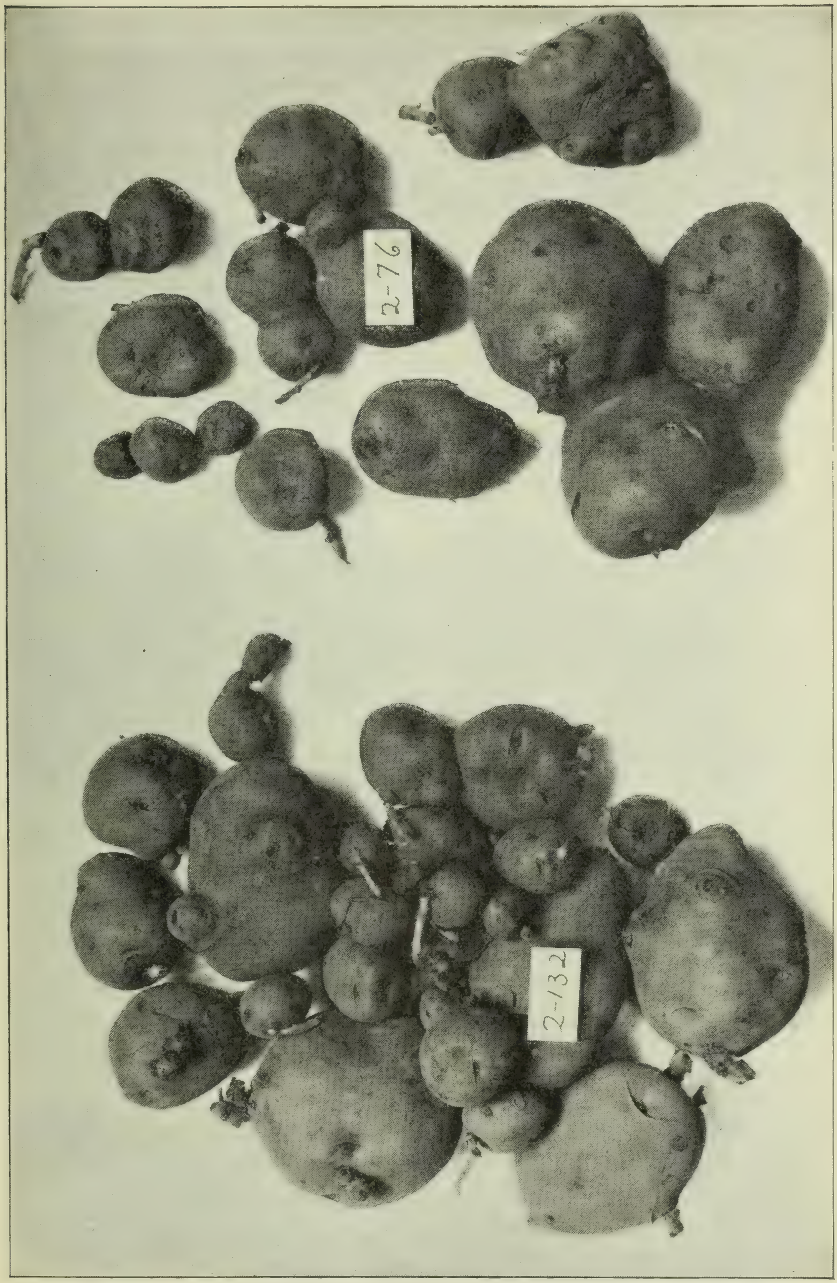

FIG. 123.— *First-year seedling potatoes. One half size*

The scientific man or the professional seedsman may still make use of the method of hybridization in order to produce new varieties of potatoes. However, there are already more than one thousand varieties of potatoes listed. It is undoubtedly true that some of these are old varieties masquerading under new names. But, even considering this, there are still a great number of distinct commercial varieties in existence. What recommendation, then, shall we make to the practical grower? Shall we merely suggest certain varieties that are more or less adapted to certain regions?

A glance at our potato statistics for the past decade should convince us that New York still has room for improvement in the production of this important crop. From the data presented in Table 1, it is seen that the ten-years average yield for the State is 88 bushels an acre. Surely our climate and soil are capable of a better record than this.

TABLE 1. TEN-YEARS AVERAGE YIELD BY STATES, 1900–1909; ALSO YIELDS FOR 1910, 1911, 1912 *

State	Yields in bushels per acre			
	1900 to 1909	1910	1911	1912
Maine	180	220	180	198
Wisconsin	92	95	116	120
New York	88	102	74	106
Michigan	88	105	94	105
Minnesota	88	61	115	135
Ohio	84	82	65	112
Pennsylvania	82	88	56	109

* U. S. Agr. Dept. Yearbook 1912, page 611.

SELECTION

There remains for the practical grower a method that has been tried and found not wanting, and that will enable him to materially increase his yield of potatoes without the expenditure of a large amount of time or money. The following statement is made by a practical potato-grower [3] who is giving close attention to both environment and heredity: "The expense of time and trouble necessary for hill selection is very small and the profit very large. Not only is the yield greatly increased, but the price is also better for improved appearance and quality."

---

[3] Daniel Dean, Nichols, New York.

Variation

The method referred to is that of individual hill selection. In the former lesson, to which reference has already been made, it was shown that the value of selection depends on the amount of variation that can be found. In other words, selection as it should be viewed from the practical standpoint is merely a process of isolation of strains already existing in the commercial variety. It is true that the majority of our commercial varieties of crops are composed of a mixture of several distinct strains, some of which are good while others are only mediocre or are poor. One eminent plant-breeder[4] has termed these strains "elementary species." It can be readily seen that the yield per acre which any

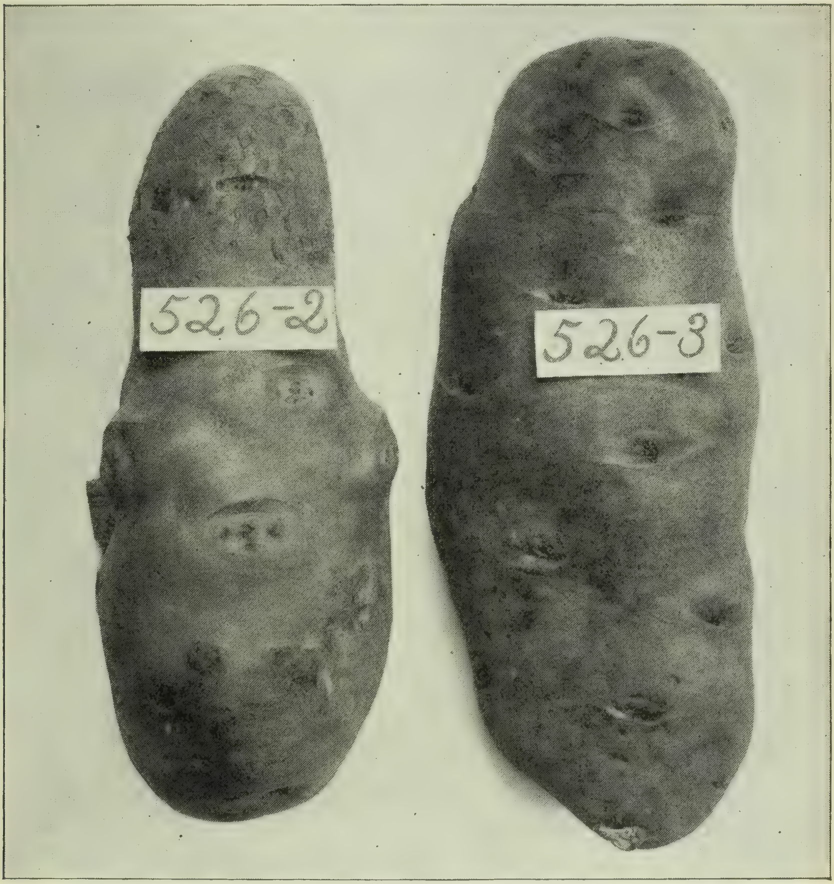

FIG. 124.— *Two tubers of Early Rose, showing variation in depth of eyes. (See Fig. 125.)*

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[4] DeVries, Hugo. The mutation theory. 1909.

crop will produce is merely the average performance record of all the different strains that may be present in the commercial variety.

The only way in which the amount of variation in a given variety of potatoes may be determined is by a test of individuals. We may choose two hundred tubers from a bin of potatoes of one variety. These tubers may appear very similar in regard to their uniformity, size, color, depth of eyes, and the like. Indeed, from external appearances we should judge that one of these tubers was just as good as another. This may be true so far as the desirability for present use as food is concerned. When we test the performance record of these two hundred parental tubers, however, we find that there is a great variation in regard to size, shape, color, eyes, and the like. Perhaps the most interesting variation will be noticed in the ability to yield. This test of indvidual variation may best be made by the use of the tuber-unit method, first suggested by Webber.[5]

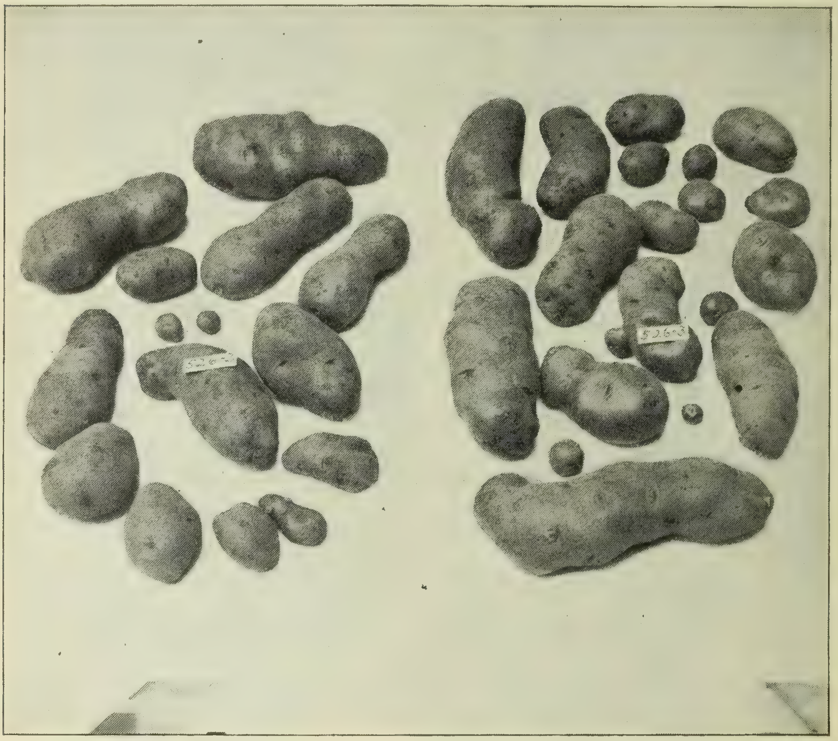

FIG. 125.— *The offspring of the two tubers shown in Fig. 124. The characteristic of depth of eye is transmitted*

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[5] Webber, H. J. Plant-breeding for farmers. Cornell University Agricultural Experiment Station. Bulletin 251. 1908. (This bulletin is out of print.)

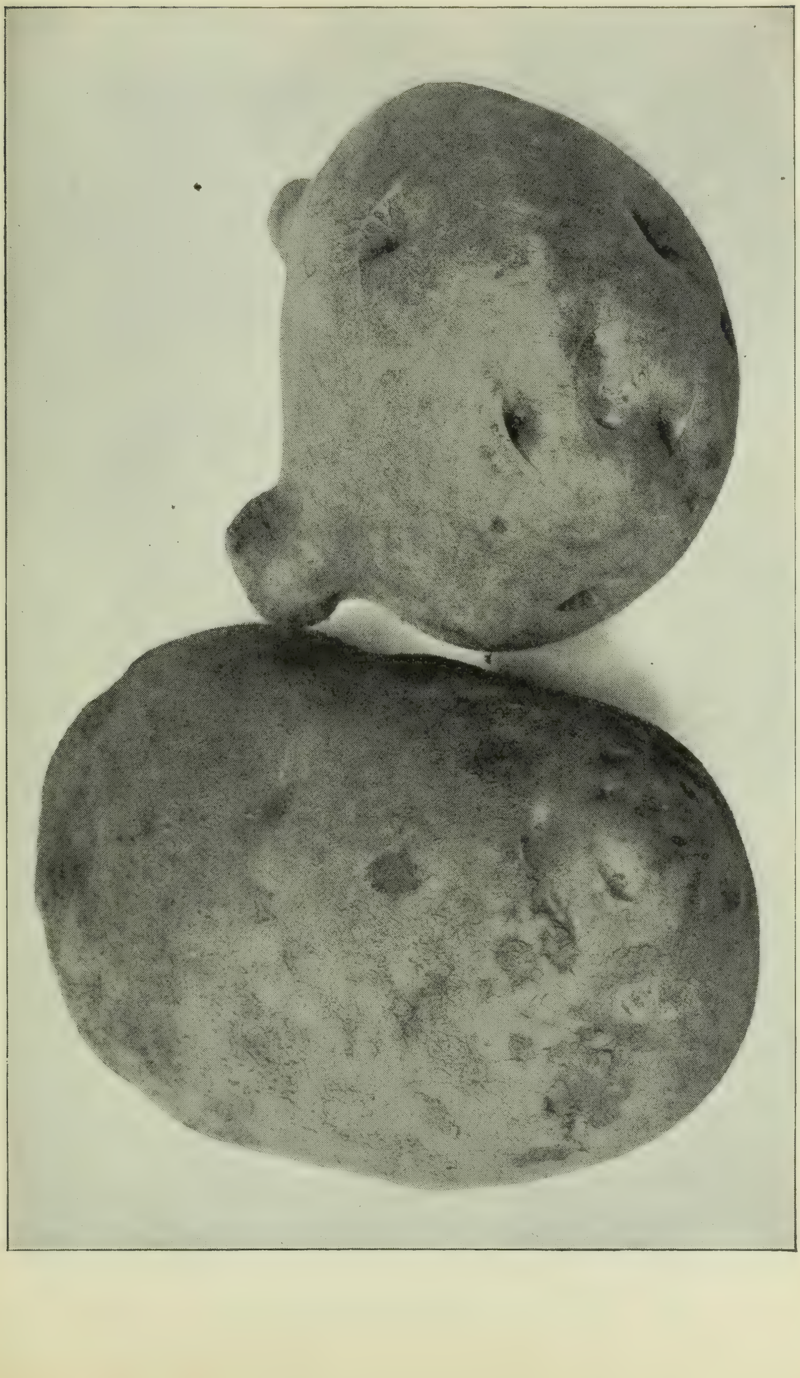

FIG. 126.— *Deep and shallow eyes from individual tubers of Moravia*

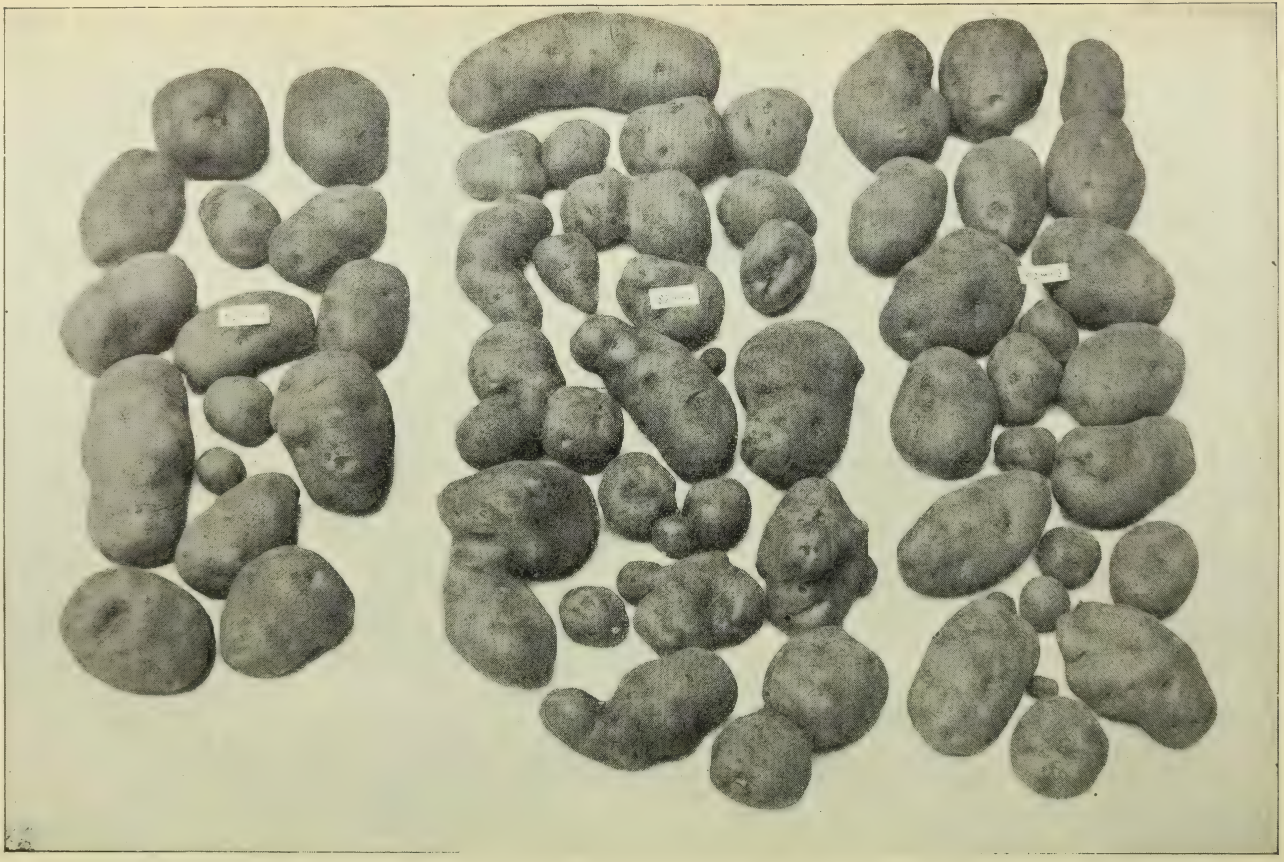

FIG. 127.— *Three tuber-units of Vermont Gold Coin, showing variation in yield and in uniformity*

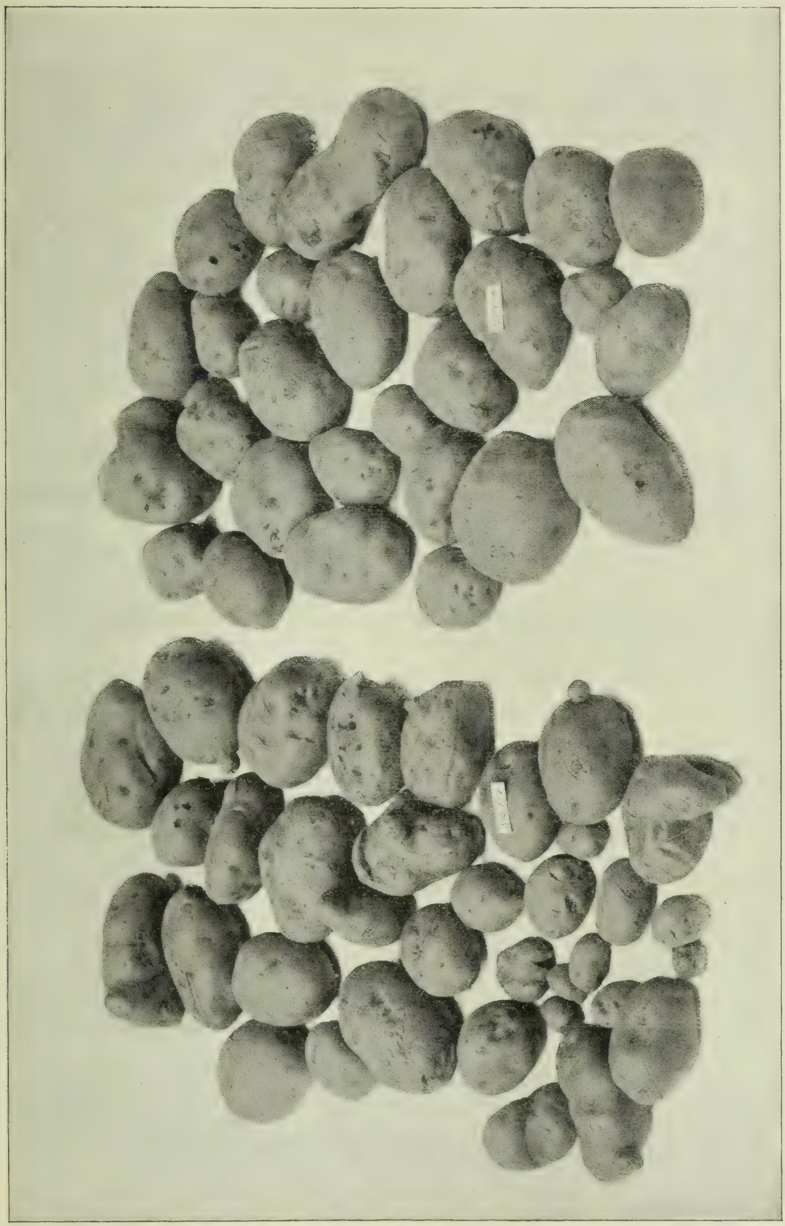

FIG. 128.— *Showing variation in uniformity of the offspring of individual tubers of Sir Walter Raleigh*

Tuber-unit method

In this method each tuber is cut lengthwise into four sections, the cutting being done from the seed end in order that some of the seed-end eyes may be in each seed piece. The four pieces of each potato are then planted in four adjoining hills. These four hills constitute the unit. The lot of two hundred tubers is planted in this manner. At harvest time each unit is dug separately. At that time the inherent differences that were in the original parent tubers will be seen. (Figs. 124, 125 and 126.) Some units will yield much more than others, although they are located side by side on the same soil. (Figs. 127 and 128.) In Table 2 is given the yield of a series of tuber-units selected at random from a breeding-plat such as is described above. An inspection of this table shows us that there was a great difference in the yielding ability of the individual tubers. The lowest unit yielded at the rate of 25 bushels an acre, while the highest yielded at the rate of 320 bushels an acre. From which unit would a farmer prefer to save seed for planting next year? Does the successful dairyman breed from the high-producing or the low-producing cows?

TABLE 2. VARIATION IN THE YIELDING ABILITY OF DIFFERENT TUBERS. EACH UNIT IS THE PRODUCT OF A DIFFERENT PARENTAL TUBER

Unit	Yield (bushels per acre)
1	110
2	220
3	220
4	230
5	280
6	320
7	240
8	230
9	230
10	130
11	210
12	70
13	190
14	190
15	25
16	270

Test of transmission

The question may arise, however, as to the transmission of this yielding ability. Will tubers selected from the high-yielding units reproduce that characteristic, on the average, in the next generation? And, similarly, will tubers from the low-yielding units reproduce that characteristic? In Table 3 are given data that throw light on this question. This table shows the results obtained in the Cornell experiments[6] by selecting from both low- and high-yielding strains for a period of five years. In 1909 the differences are not so apparent from the table, because, for the most part, the low-yielding units produced a small yield of merchantable tubers; but in two instances there were enough small, unmarketable tubers in these units to make them actually weigh more than the units that were selected as high yield. Beginning with the crop of 1910, there is a very striking difference between the strains, which has been transmitted for four bud generations.

TABLE 3. RESULTS OF SELECTION FROM HIGH-YIELDING AND FROM LOW-YIELDING STRAINS OF POTATOES

	Yield per hill in grams						5-years average in bushels per acre
	1909	1910	1911	1912	1913	5-years average	
Low yield	693	43	32	76	101	189	67
High yield	307	619	390	1,840	395	710	251
Low yield	1,044	130	37	107	97	283	100
High yield	977	550	480	544	322	575	203
Low yield	659	202	64	62	141	226	80
High yield	706	410	281	673	357	486	171

Five-years average of 3 low-yielding strains, 82 bushels per acre.
Five-years average of 3 high-yielding strains, 208 bushels per acre.

The yields in this table are based on the average yield per hill. For a better comparison the five-years average is given also in bushels per acre. The five-years average of the low-yielding strains is 82 bushels an acre, while that of the high-yielding strains is 208 bushels an acre. In Fig. 129 this comparison is shown graphically by means of wire cylinders. The height of the column in each cylinder represents the comparative yield of that strain.

Results similar to the above have also been obtained by practical growers. Mr. Dean, who began his hill selection in 1904, has obtained excellent results. He did not retain any of the low-yielding strains for comparison until 1912. In Table 4 are arranged his comparative yields of good and poor strains in 1912–1913.[7] In 1912 the good strain outyielded the poor strain at the rate of 280 bushels an acre. In 1913 the difference in favor of the good strain was at the rate of 140 bushels an acre. The difference would have been greater in 1913 except for the early frost. At that time the vines of the poor-yielding strain were dead,

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[6] The potato-breeding experiments at Cornell were started by Dr. H. J. Webber, who conducted the work until he severed his connection with the College in 1913. At that time the work was transferred to the writer.

TABLE 4. COMPARATIVE YIELD OF GOOD AND POOR STRAINS OF POTATOES, ISOLATED BY HILL SELECTION, BY DANIEL DEAN, NICHOLS, NEW YORK

	1912	1913
Good yield, bushels per acre	350	290
Poor yield, bushels per acre	70	150
Increase due to selection	280	140

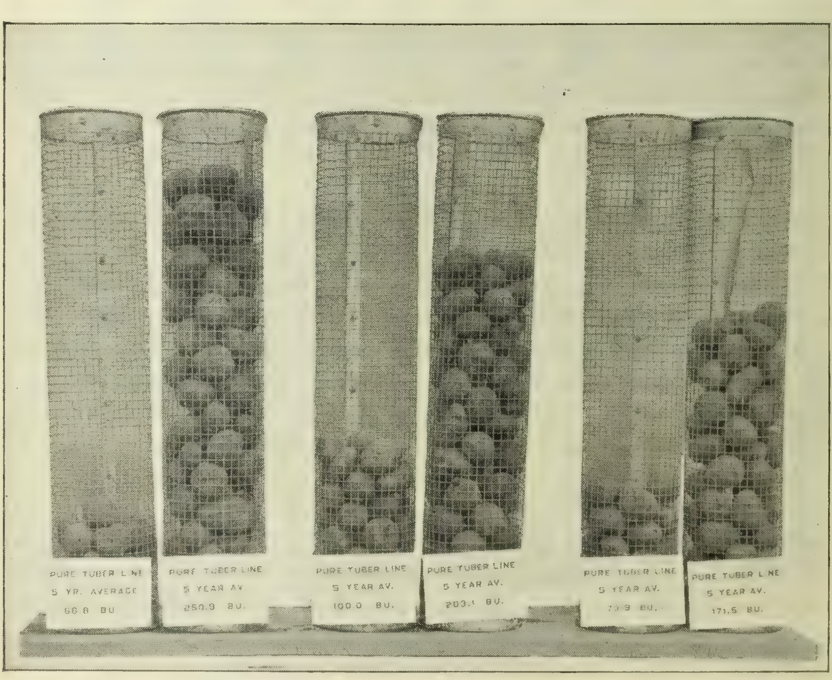

FIG. 129.— *The height of potatoes in the cylinders represents the five-years average yield of six different strains isolated by individual selection. A high- and a low-yielding strain have been isolated from each of three commercial varieties*

while those of the high-yielding strain were still green and growing when they were cut down by the frost.

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[7] The data for this table were kindly furnished the writer by Mr. Dean.

In the cooperative breeding-plat conducted by G. D. Brill, a comparison was made in 1913 between a low- and a high-yielding strain isolated from the same commercial variety by selection. The former yielded at the rate of 166 bushels an acre, while the latter yielded at the rate of 273 bushels an acre. In this instance the gain due to selection was 107 bushels.

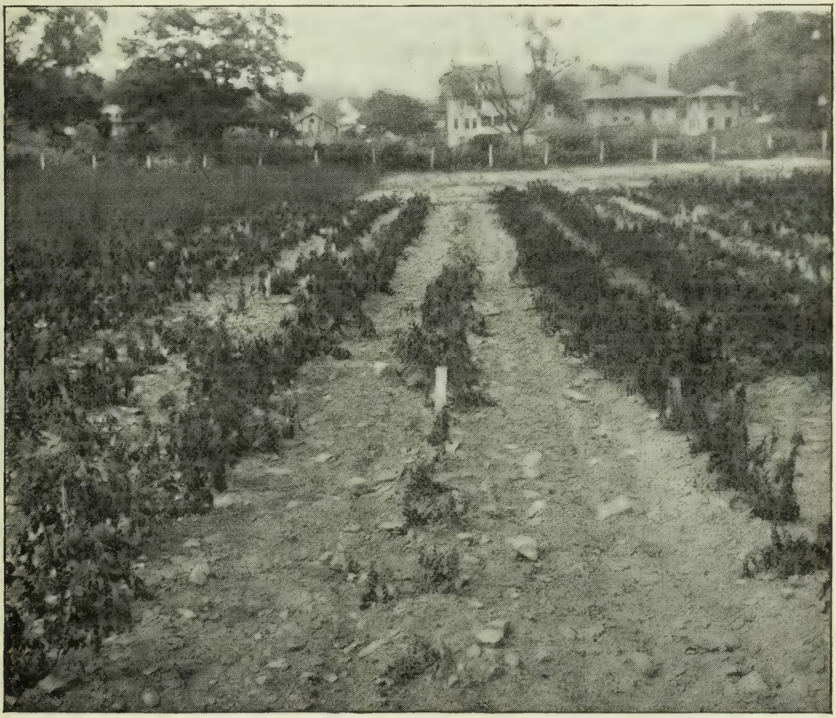

FIG. 130.— *High- and low-yielding strains of potatoes growing side by side. Plant-breeding garden, Cornell University*

It must not be concluded that all these different strains of potatoes have been " created " by selection. As stated above, they already existed in the commercial variety, and it remained only for them to be isolated by the process of selection. (Fig. 130.)

The data that have been given thus far have to do only with yield. Variation occurs in regard to many other characteristics, such as size, shape, color, depth and shape of eyes, and the like. In these instances the transmission of the characteristics from one bud generation to another is just as pronounced as in the case of the yielding ability. Thus, from a commercial variety such as Rural New Yorker, both a long and a round tuber strain may be obtained by individual selection.

RUNNING-OUT OF SEED

Much has been said about the running-out of seed, and many growers still advocate a frequent change of seed in order to keep up the productive ability. This is a popular notion which is held in regard to many of our agricultural crops. Experimental evidence, however, does not substantiate this view. Home-grown seed, if properly selected and cared for, is nearly always superior to seed brought from a distance. This is probably true of all of our agricultural crops. All evidence points to the fact that for the greater part of New York State the same variety of potatoes can be grown continuously on the same farm if seed selection is practiced. There are certain restricted areas, such as Long Island, where this may not be true, although it has not been conclusively demonstrated as yet.

It is probably true that in many cases varieties of potatoes have seemed to degenerate, or run out. But it is probable that in such cases the seed was selected hurriedly from the bin, if indeed it was selected at all. It is certain that in many cases only small potatoes were planted. A small potato from a high-yielding hill is good, for, as a rule, the potato tends to reproduce the characteristics of the hill. It is true also that the majority of small potatoes are produced in the poor hills; therefore, when all small potatoes are planted, it is a mathematical certainty that a larger number of poor-yielding hills will be represented in the seed stock, and the poor-yielding characteristic will be reproduced.

The results in Table 3 show the yields of different strains grown for five years at the Cornell University farm. It is true that five years is not a very long period of time, but it would seem that indications of degeneracy would begin to appear in that time if a tendency to run out really existed. No such indications have appeared. The different strains have remained true to their characteristics in a remarkably uniform manner. The low-yielding strains have been low each year, while the high-yielding strains have been correspondingly high. There have been, of course, seasonal fluctuations in which different strains have responded differently to seasonal conditions. For example, in 1912 the first high-yielding strain given in the table was remarkably high. Evidently the seasonal conditions were unusually favorable to this strain.

The results of some experiments conducted at the Ontario Agricultural College are interesting in this connection. In these experiments several crops, including potatoes, have been grown continuously for twenty-one years without change of seed. The data are given in Table 5. An inspec-

TABLE 5. YIELDS OF POTATOES GROWN WITHOUT CHANGE OF SEED FOR TWENTY-ONE YEARS *

Variety	Bushels per acre		Average bushels per acre		
	First year	Last year	First eight years	Last eight years	Whole period
Empire State	162.0	295.0	207.2	224.6	225.1
Rural New Yorker No. 2	129.0	284.2	178.5	207.8	204.8
The Daisy	157.5	330.0	166.6	231.5	211.4
White Elephant	67.0	323.3	159.5	228.4	206.3
Rose's New Invincible	78.0	318.8	164.2	232.1	211.1
Stray Beauty	49.0	249.2	139.6	185.1	164.3

* Ontario Agricultural College. Report 1910, pages 178–179.

tion of these results shows that there has evidently been no running-out of the variety. In the case of the two varieties Empire State and Rural New Yorker, the average yield for the first eight years was less than that for the last eight years, which was practically the same as the average for the whole period. In the case of the other four varieties, the average yield for the first eight years was considerably less than that for either the last eight years or the whole period. It would seem that these varieties had become better in yielding ability during this period of time. This is probably due to better methods of cultivation and to the fact that the varieties are becoming adapted to their conditions. It is stated that during the progress of these experiments the soil has changed but little and that no plant selection has been practiced.

The experimental data quoted above are further verified by the observations of practical growers who have selected their own seed for a number of years. This refers especially to men who have practiced some form of individual hill selection, even though it was not the tuber-unit method. There are many growers in New York State who save their own seed potatoes, year after year, without the occurrence of any degeneracy.

It was stated above that any individual tuber, no matter what its size or appearance would indicate, tends to reproduce the characteristics of the hill from which it came. This point is well illustrated in Table 3, in which the performance record of certain strains is given year by year. In every instance the low-yielding strains have been low each year, while the high-yielding strains have been high. In other words, each strain reproduced the characteristics of the original hill from which it came.

There is, however, a certain amount of bud variation occurring within pure-tuber lines. By a "pure-tuber line" is meant the offspring of one parent tuber. This bud variation is often in the nature of a degenerate type; that is, a poor-yielding strain may split off from a high-yielding pure-tuber line. In one instance a red strain has originated from a pure-tuber line of white potatoes. Such bud variations as these, however, will not affect the work of the practical grower, for they occur with comparative infrequency and will immediately be eliminated if the grower is practicing a careful system of selection. The occurrence of this bud variation is mentioned in connection with this lesson because it emphasizes the necessity of continuing our potato selection year after year in order that we may eliminate any types occurring that may not be suitable to our needs and demands. Such a procedure may not be necessary in the case of self-pollinated cereals, such as wheat or oats, but it is certainly advisable in potato-growing, in which the time and labor necessary is not a very important factor.

COMPARISON OF BASE AND APEX

In this connection it is interesting to note the results that have been obtained in making a comparison between the basal (stem) and apical (seed) ends of individual tubers. There are varied notions among practical growers in regard to the relative merits of the two ends of the tuber. None of these, apparently, are founded on experimental data.

During the course of the Cornell experiments, considerable data have been obtained on this point. In all the pedigree cultures each individual tuber has been cut horizontally, thus separating the stem and the seed end. These pieces have been trimmed to approximately the same size, in order to eliminate any difference that might result from different-sized seed pieces. The results of this comparison are shown in Table 6. The five-years average yield from the apical ends is 159.4 bushels, while that of the basal ends is 132.4 bushels. There is a difference of 27 bushels an acre in favor of the apical end. It is also true that, in general, the potatoes from the apical hills are a little larger and more uniform than those from the basal hills.

It is in view of these results that the recommendation is made to cut the tubers lengthwise for tuber-unit planting.

METHODS OF HILL SELECTION

For the guidance of those who are ready to begin potato selection, it may be well to outline some specific plans or suggestions. It is better to practice some form of individual selection. Mass selection is very simple and will be effective, although the tuber-unit method will yield better and earlier results to those who are willing to give the extra time and labor.

TABLE 6. COMPARATIVE YIELD OF BASE AND APEX. AVERAGE OF TWENTY-ONE VARIETIES FOR FIVE YEARS

Variety	Bushels per acre	
	Apex	Base
Rural New Yorker	158.4	141.6
Rural New Yorker No. 2	183.6	142.6
Moravia	172.4	142.4
Vermont Gold Coin	159.3	127.5
Vermont Gold Coin	135.4	120.3
Early Rose	171.6	139.0
True Early Rose	157.6	137.3
Early Ohio	187.0	156.7
Sir Walter Raleigh	182.8	147.6
Burpee's Great Divide	164.4	137.0
Burpee's Great Divide	133.4	116.9
Late Puritan	166.2	138.4
Alcohol Potato 19582	181.0	159.8
*Alcohol Potato 19583	178.1	145.9
*Alcohol Potato 19585	119.7	113.9
Early Beauty Hebron	188.2	132.6
*Eureka Extra Early	90.9	72.3
State of Maine	166.2	137.8
Green Mountain	116.5	94.1
Carmen No. 3	216.0	179.4
†White Victor	119.7	98.3
Average of all varieties	159.4	132.4

* Four-years average.
† Three-years average.

Method for mass selection

In mass selection the method is to dig a large number of hills of potatoes, perhaps two thousand or more, each year. The potatoes from the best of these hills are selected by inspection and thrown together to be planted in an increase seed plat, which can be located in a section of the regular field. This seed plat will furnish a supply of seed potatoes to be used in the regular field, and it should have newly selected hills brought into it each year from the general field or from other sources, as may be available.

Method for tuber-unit selection

For the man who has the time and who wishes to advance more rapidly in the improvement of his potato crop, the tuber-unit method is the better.

It is much more nearly accurate and will give results sooner than the method of mass selection. For the use of those who wish to pursue this method the following detailed directions are given:

First year.— Select five hundred tubers of ideal shape and size for planting, giving each a pedigree number, from 1 to 500. This first selection is very important, therefore it is best to deal with a large number of individuals in the first year. Cut each of these tubers into four pieces of approximately equal size, cutting from end to end so that each seed piece will contain a part of the stem end and a part of the seed end. Plant each piece in a hill by itself, having each four-hill unit (the four hills from one tuber) marked by a number corresponding to the number of the original tuber. Treat these breeding hills in the same manner as the general crop.

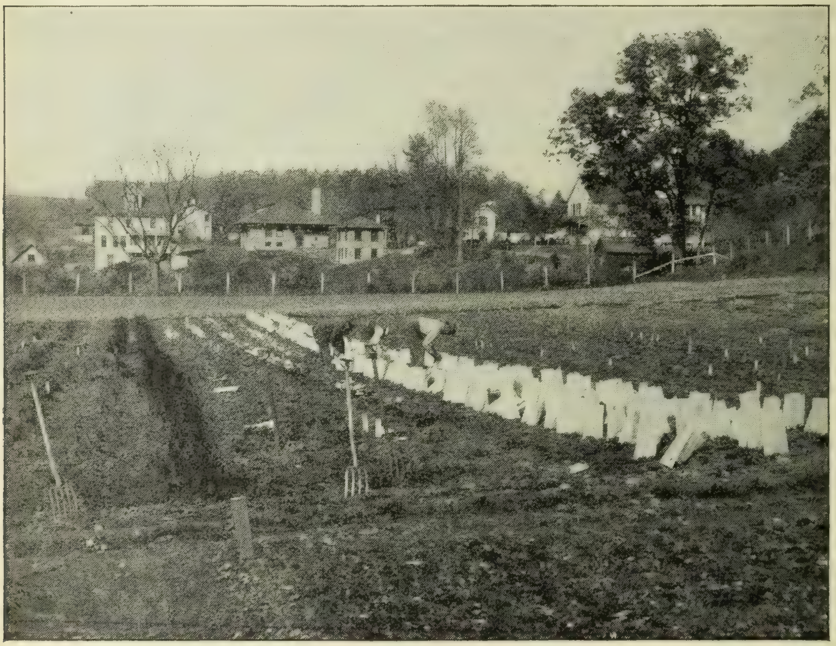

FIG. 131.— *Harvesting experimental plats of potatoes in the plant-breeding garden, Cornell University*

At harvest time dig the four hills comprising a tuber-unit by themselves, throwing the potatoes together in one pile. Then go through the breeding patch and discard all tuber-units that are obviously poor in shape, size, or color of tubers, or in total yield.

Next select the fifty tuber-units having the highest yield. This can be done by using an ordinary set of grocer's scales. Retain ten good-sized tubers from each of the fifty selected tuber-units and discard the rest. The tubers saved may be kept over winter in twelve-pound paper bags. Record on each bag the pedigree number and the weight of the tuber-unit.

There will be fifty bags, containing ten tubers each, to be stored over winter.

Second year. — Each of the five hundred tubers that have been retained for the work of the second year should be cut into four pieces as before, and each piece planted separately. Each of the five hundred tubers should be given a new pedigree number, so that the progeny of each can be identified in order to compare this with the yield of its mother parent. For example, suppose that tuber No. 25 of the first year gave a very high yield. The actual yield of No. 25 would, of course, be found at the end of the first year. This yield would be recorded on the bag containing the ten tubers from tuber No. 25. At the beginning of the second year give each of the tubers in bag No. 25 a new pedigree number, thus: 25–1, 25–2, 25–3, and so on to 25–10.

FIG. 132.— *Harvesting a potato-breeding plat in Orange county, New York*

At the end of the second year proceed as before. Throw together in one pile the potatoes in the four hills forming each tuber-unit. Discard all poor tubers and select, as before, the fifty giving the highest yield. Retain ten tubers of each, and record on the bags the pedigree numbers and weights, as at the end of the first year. Most of the tubers from the breeding-patch of the second year will be select tubers. After the five hundred tubers for the third-year planting have been selected, retain all remaining tubers for the general field crop of the third year.

Third year.— Proceed exactly as at the beginning of the second year. It will be necessary to give each tuber a new pedigree number, which may be done as follows: Suppose that tuber No. 28–8 of the second year should give a high yield and its progeny should be retained for planting in the third year. The ten tubers in the bag marked 25–8 should now be numbered according to the system suggested above, thus: 25–8–1, 25–8–2, 25–8–3, and so on. This system of numbering will allow the breeder to know the performance in pounds per hill of the ancestors of each selected hill. This is just as desirable as to know the pedigree of a dairy cow.

FIG. 133.— *Digging potato-breeding plat at Lincoln Agricultural School, Lincolndale, New York*

By the use of the above method the potato crop can be materially improved. The results of experiments at various agricultural colleges and experiment stations, together with the results obtained by practical growers in many parts of the country, confirm this conclusion.

There is an excellent opportunity for men who are located in the best potato sections to grow selected strains as seed for others who are not so well located or who are not willing to give their own time and attention to such work. There is a large demand for selected pure strains of all our agricultural crops, and most growers are willing to pay a fair advance over the market price for such seed.

The method of individual hill selection is applicable and practical for the greater part of the State of New York, which is one of the leading potato-producing States in the Union. If we are to maintain our position in the production of this important crop, we must take advantage of all our opportunities. Let us not neglect this important question of the selection of our seed stock. Along with the important factor of environment, let us make use of the factor of heredity.

SUPPLEMENT TO

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VOL. III. No. 68 JULY 15, 1914 **PLANT-BREEDING SERIES No. 3**

IMPROVING THE POTATO CROP BY SELECTION

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of bringing out the main points covered or of calling attention to related agricultural facts, practices, or methods. The College encourages an expression of opinion or a statement of experience by means of the questions asked. Each discussion paper filled out and returned will be read carefully and a personal reply will be made if agricultural information is desired regarding personal or community problems or the subject studied.

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(In answering questions, attach additional paper if needed and number the answers.)

1. Have you ever seen potato seed balls? How frequently do they occur on your farm? Have you ever raised potatoes from seed? What results did you get?

2. Can potatoes be improved by hybridization?

3. Have you practiced the method of individual hill selection?

4. Which of the two methods, hybridization or selection, do you think is better for the practical grower? Why?

5. What is meant by the tuber-unit method? Is this mass or individual selection?

6. In what respects do the offspring of different tubers vary? Are these differences due to environment or are they transmitted from one generation to the next?

7. What do you think about the running-out of seed? What evidence have you that seed does run out? Do you know of potato-growers who have used the same seed for a number of years?

8. Do you know of growers who at planting time throw away the seed end of the potato? Is this a good practice?

9. Are you satisfied with your yield of potatoes? What do you think of the ten-years average yield for New York?

10. What is your opinion of the detailed directions for a potato-breeding plat given in this lesson?

Name..

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SOIL MOISTURE AND CROP PRODUCTION

ELMER O. FIPPIN

The large use of water by plants and its derivation from the soil are facts commonly understood. The object of this lesson is to point out the extent to which plants use water and the manner of its use, and to explain the ways in which water is collected and conserved in the soil for this purpose.

FIG. 134.— *Corn growing in a soil covered by an excellent dust mulch*

USES OF WATER BY PLANTS

The water used by plants serves many purposes. It is continually given off by the plant surface, especially by the leaves. This may easily be shown by placing a glass jar or other closed vessel over a growing plant. Drops of moisture will collect on the inner surface of the vessel as a result of transpiration. The familiar phenomenon of wilting is merely an indication that water is being lost somewhat more rapidly than it is absorbed from the soil by the roots. As a result of that process the soft, herbaceous parts of plants lose their crisp form and become soft and limp. If the wilting becomes excessive the plant is likely to die. When such a condition is reached, all the various functions of water in the plant and in the soil have ceased to be performed effectively.

The functions of water in plant growth are: (1) It gives strength and form to the balloon-like cells of which plants are composed, by keeping them fully distended, and (2) it serves as food. Its elements, hydrogen and oxygen, are separated and built into the structure of the plant tissues; and, in addition, water as such is an essential constituent of many plant materials. Water and its elements make up about fifty per cent of the dry weight of plants and over ninety per cent of the green weight. (3) Water dissolves plant-food in the soil and carries it into the plant. It also distributes the elaborated materials in the plant to the parts where they are used. (4) By evaporation the plant is protected somewhat against temperatures high enough to cause injury to its delicate tissues.

QUANTITY OF WATER USED BY PLANTS

The quantity of water which is used by plants for these purposes, and which the soil must supply, is very large and varies considerably for different plants. By determining this total quantity and comparing it with the annual water supply either from rainfall or from irrigation, and also by determining the capacity of the soil to hold water for the use of plants and the possibility of increasing its conservation by appropriate methods of soil management, one may see to what extent larger crops are possible with the normal rainfall.

The most practicable method of determining the use of water by plants is to measure the amount evaporated from the plant surface during the entire period of growth and divide that by the amount of dry plant material produced. This shows the quantity of water used to produce a unit of plant material.

Many measurements of this sort have been made. The quantity of water used varies not only with the kind of plant, but also with the climate and in a minor way with many other conditions. The figures in the following table represent the approximate range in the quantity of water used by a number of common crops under a climate ranging from moderately humid to semi-arid. There is also calculated the number of inches of rainfall that would be required in order to meet that need for water where large yields are produced. The yields stated indicate the general growth, but the weight of the entire top is used as the basis of the calculations.

TABLE 1. QUANTITY OF WATER USED IN PRODUCING SOME COMMON CROPS

Crop	Water requirement per pound of dry matter in tops (pounds)		Yield per acre		Inches of rainfall* used in producing crops	
	Minimum	Maximum	Bushels or tons	Total dry matter (pounds)	Minimum	Maximum
			(bushels)			
Corn	250	375	100	10,000	11.0	16.5
Potatoes	300	450	300	6,000	8.0	12.0
Peas	300	800	40	6,000	8.0	21.0
Wheat	250	500	40	6,500	7.0	14.0
Oats	400	600	70	7,000	12.0	18.5
			(tons)			
Red clover	300	500	4	7,000	9.0	15.5
Alfalfa	600	1,000	6	10,000	26.0	45.0

* One acre of water one inch deep weighs approximately 113.5 tons.

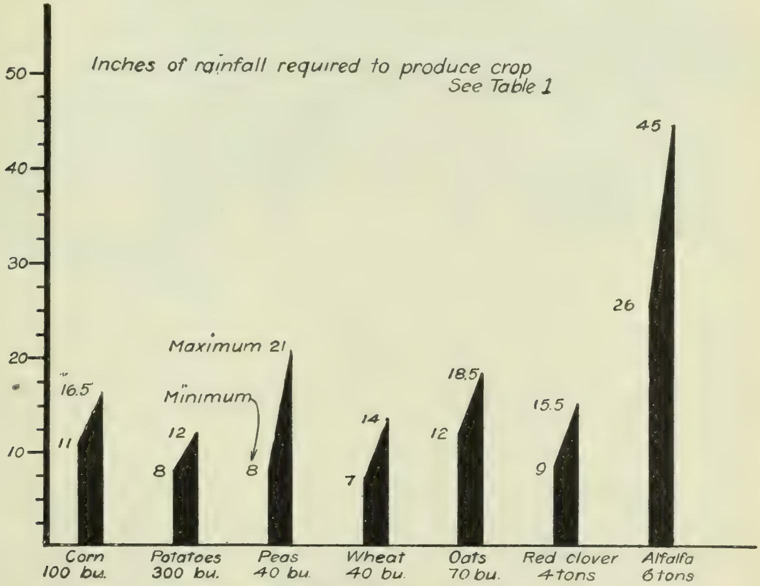

FIG. 135.— *Minimum and maximum rainfall used in producing some common crops*

From Table 1 it is seen that the total quantity of water required for the plant to produce these large yields ranges from seven to forty-five inches. If the yields are divided by two, the amount produced will still be regarded as a fair yield; and if the water used is calculated to the mean of the figures given, the actual quantity required by crops under average New York conditions will be found to range from five to eight inches of rainfall — except for alfalfa, which uses somewhat more than twice this quantity, or about eighteen inches. This large use of water by alfalfa is probably an important reason for its deep root system, designed to bring the plant in touch with the supply of moisture in the deep subsoil.

The depth of the root system and the thoroughness of its distribution are important factors to be taken into account in controlling soil moisture for different crops.

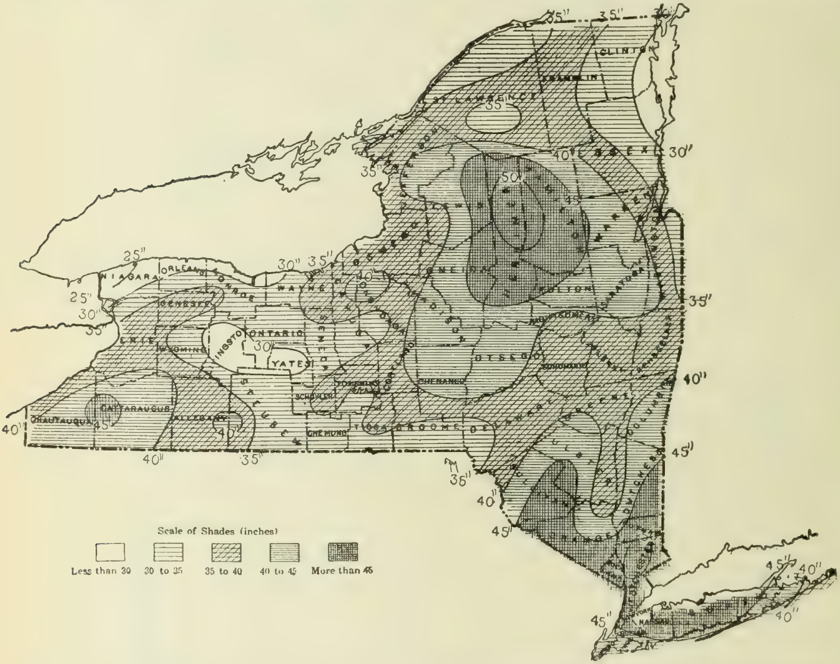

FIG. 136.— *Map of New York State, showing the annual distribution of rainfall*

ANNUAL PRECIPITATION

The annual precipitation in the form of rain and snow for the greater part of New York State is thirty to fifty inches. Limited areas have a smaller or a larger amount of precipitation, but these figures may be taken to fairly represent the soil water supply. Of this amount, eight to fourteen inches fall during the summer, at the rate of two or three inches a month. It is clear, therefore, that in New York the rainfall is adequate for the production of large crop yields. The limiting factor, so far as water supply is concerned, is the capacity of the soil, either naturally or under the management of the farmer, to retain sufficient water within reach of the plant roots to carry them through the periods between rains.

MANNER IN WHICH WATER IS HELD IN THE SOIL

It has been seen in an earlier lesson[1] in this series that the soil is normally a porous mass of rock and organic particles. The water derived from precipitation falls on the soil and sinks into the pore spaces. Each particle of the soil holds a film of water on its surface. This is due to the fact that the attraction of the soil particles at their immediate surface is great enough to separate the mass of water and retain some of it; in other words, at the surface of the soil particles water is attracted more by the soil than by its own material. This attractive force is exerted for only a very short distance from the surface of the particles, and any film thicker than the range of that attraction is due to cohesion of the water. The extent of this cohesion is indicated by the thickness of the film of water at the instant when drops form.

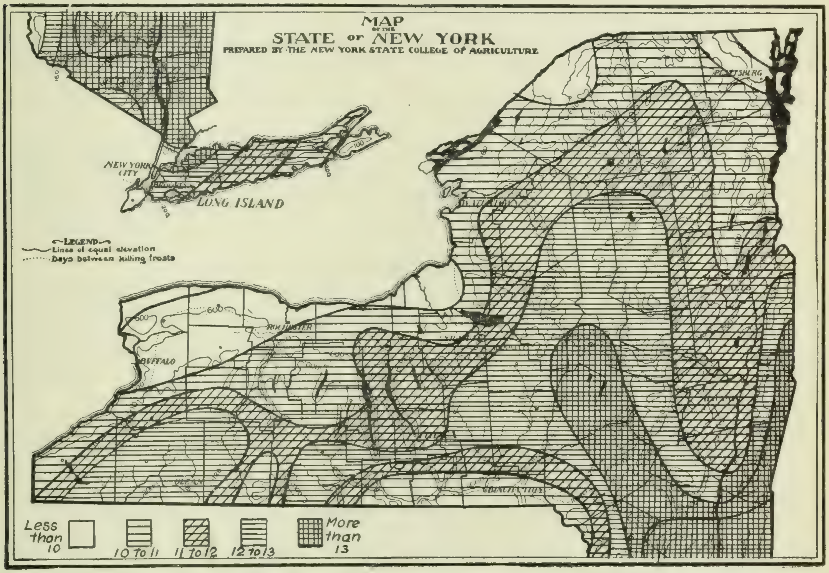

FIG. 137.— *Map of New York State, showing the distribution of rainfall during the three crop-growing months June, July, and August*

Since each particle of soil is covered by a film of water, the first factor in the determination of the quantity of water that a soil will retain is the extent of surface of the soil particles. The greater surface a soil has, the larger is the quantity of water it may be expected to hold.

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[1] No. 42, June, 1913.

The extent of surface in a mass of soil is determined by its fineness. The finer the soil, the larger is the extent of surface of the particles in a unit of mass. The extent of surface in a cubic foot of clean sea sand is less than one quarter of an acre. In a sandy loam soil it is one to two acres. In a loam or silt loam soil it is two to three acres. In a clay loam it is three to four acres, and in heavy clay it may be more than five acres. When free to do so, all particles of whatever size will hold the same thickness of water film on their surface. Consequently loam and clay soil holds much more water than does sand.

The surface of the soil particles is not the only factor that determines the retention of water. Due to internal physical forces the surface of water acts like a stretched membrane. It is in tension and always tends to assume the form that has the least surface. This is the reason why raindrops are spherical. When two soil particles each bearing a film of water are brought in contact the water films unite and form a waist, or connecting neck, at the point of contact. The film of water thickens in that part, and if one of the soil particles is in contact with a supply of water this neck will increase in diameter until it fills the angle between the particles, and the surface of the water becomes either plane or hemispherical. This is the phenomenon of capillarity. A concave, or dished, film of water exerts suction in its effort to straighten out. A convex, or bulging, form of water surface exerts pressure and will force water through the soil. Capillary, or film, water in the soil normally presents concave surfaces, which are increasingly dished as the water in the soil is reduced. If a series of wet particles are connected, the water will shift back and forth until all the curves of the water surfaces are the same; which means that all have the same pull and consequently balance one another, and the water remains at rest. As the quantity of water in the soil is reduced, the connecting necks of water become successively smaller; and finally they are broken, beginning where the soil particles are most widely separated.

In the soil there are many points of contact between the particles, and consequently many small necks of water. The smaller the particles, the more numerous are these points of contact. This is a further reason why fine-textured soils hold more water than do coarse-textured soils. Water held in this way is called *film*, or *capillary*, *water*.

Capillary water in soil

The quantity of capillary water held by different soils in good tilth, or physical condition, is shown in the following table:

TABLE 2. QUANTITY OF CAPILLARY WATER RETAINED BY DIFFERENT SOILS

Texture of soil	Weight per cubic foot (pounds)	Percentage of water retained	Inches of water retained in three feet depth of soil
Beach sand	110	4	2.5
Light sandy loam	100	10	5.8
Fine sandy loam	90	15	7.8
Loam	85	20	9.8
Silt loam	80	25	11.5
Clay loam	75	35	15.0
Heavy clay	70	45	18.0
Muck	15	200	17.0

In the last column of the table it is seen that a section of soil three feet in depth is able to hold as much water as falls in one to six months, depending on the physical properties of the soil.

Unavailable water in soil

Not all the water in the soil can be used by plants. Some is permanently unavailable to plants, due to the tenacity with which it is held by the soil. This occurs when the films on the soil particles become very thin. Therefore the quantity of unavailable water is proportioned to the fineness of the soil. It is greatest in clay soil, which has the greatest extent of internal surface, and it is least in clean sand and gravel.

Using the same soils as in Table 2, the approximate amount of unavailable and available water in a section three feet deep is shown in the following table:

TABLE 3. AVAILABLE WATER RETAINED BY DIFFERENT SOILS

Texture of soil	Weight per cubic foot (pounds)	Percentage of unavailable water	Inches of unavailable water in three feet depth of soil	Inches of available water in three feet depth of soil
Beach sand	110	1	0.6	1.9
Light sandy loam	100	4	2.3	3.5
Fine sandy loam	90	7	3.6	4.2
Loam	85	12	5.8	4.0
Silt loam	80	15	6.0	5.5
Clay loam	75	20	8.6	6.4
Heavy clay	70	30	12.0	6.0
Muck	15	100	8.7	8.3

It is evident from Table 3 that any except the very lightest sand soils are able to hold enough available water to largely meet the requirements of crops for moisture and to bridge over the periods between rains. It is to be remembered that to these quantities is added the rainfall during the growing period, amounting usually to four to ten inches. The soils under consideration are supposed to be in perfect physical condition to a depth of three feet. It has been clearly shown in investigations in Western States that plants can utilize water stored at a much greater depth than three feet, but this depth may be taken as the ideal for Eastern conditions. There may be a water-table or other available forms of water below three feet in depth that may be drawn upon to replenish moisture lost from the upper part of the soil sections.

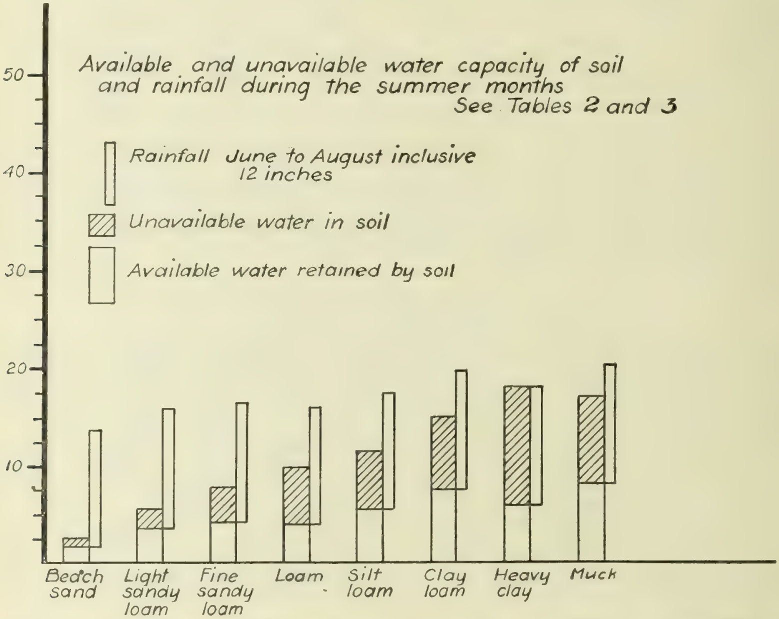

FIG. 138.— *Diagram representing the amount of total, unavailable, and available water retained by a three-foot section of soils of different texture. To the available water retained is added the average rainfall within the crop-growing season. This gives the total amount of water that can be made available to growing crops*

Control of water capacity of the soil

Insuring absorption of precipitation

The first problem of the farmer is, how to put his soil in condition to absorb water as it comes in the form of rain or snow. If the surface is very compact and sloping, the water may run off over the surface before it can be absorbed. Especially is the maintenance of a loose, open surface soil desirable during the summer, when the rainfall is likely to come in heavy, dashing showers and when the topsoil is dry. If the soil is fine and compact, the air is trapped and water can find admission only as the air slowly escapes — much as a jug can be filled only as the air escapes. The flow of the water over the surface may also cause serious erosion.

Increasing retentive capacity of the soil

If the capacity of the soil to absorb water is reduced by its physical condition, it is the function of the farmer to practice such methods of tillage and management as will improve that condition. The soils that naturally remain in the best physical condition are the silt and the sandy soils; the loam and the clay soils are more likely to get into bad condition.

There are two extremes to be guarded against: one is the very open condition typified by coarse sand and gravel; the other is the very compact, dense condition represented by puddled clay.

Management of sand soil.— In coarse sand soil the surface of the particles is small in extent, the points of contact between the particles are few in number, and the individual spaces are relatively large. Such a soil has a low water capacity and is so well ventilated that organic matter rapidly decays. Since the particles of soil cannot be pulverized, the desired change must be accomplished in another way. Several courses are open.

First, such a soil should be kept as compact as possible. It is better plowed in fall than in spring, in order that excess water of the winter may bring the particles close together. If humus is not being applied, shallow plowing is better than deep plowing, since the operation of plowing loosens the soil. The roller should be used freely. Even sand is made up of particles of different sizes, and if it is plowed when a little wet it may be partially puddled, which is a favorable condition in soil inclined to be very loose. In that case the small particles are worked into the larger spaces and reduce their average size to a more effective diameter. This increases the quantity of water retained.

Second, material may be added to the soil to partially fill the large spaces and increase the number of points of contact. The most desirable material for this purpose is humus — decayed organic matter. Clay would have a similar effect, but its use is not so practicable and it also introduces some disadvantages. Increase in the stock of humus and its deep incorporation is therefore effective to increase the water capacity of light sand soil, and, when coupled with deep plowing and the use of compacting implements, the best results are attained. The introduction of the humus more than offsets the disadvantage of deep plowing.

Management of clay and puddled soils.— In very fine-textured soils, such as clay, and in loams and sandy loams that are in a puddled condition, the pores are so small in size, and may also be so small in total volume, that the soil has a very low capacity to hold available water. Clay soil is especially prone to be in such a compact condition, and great care must be exercised in its management.

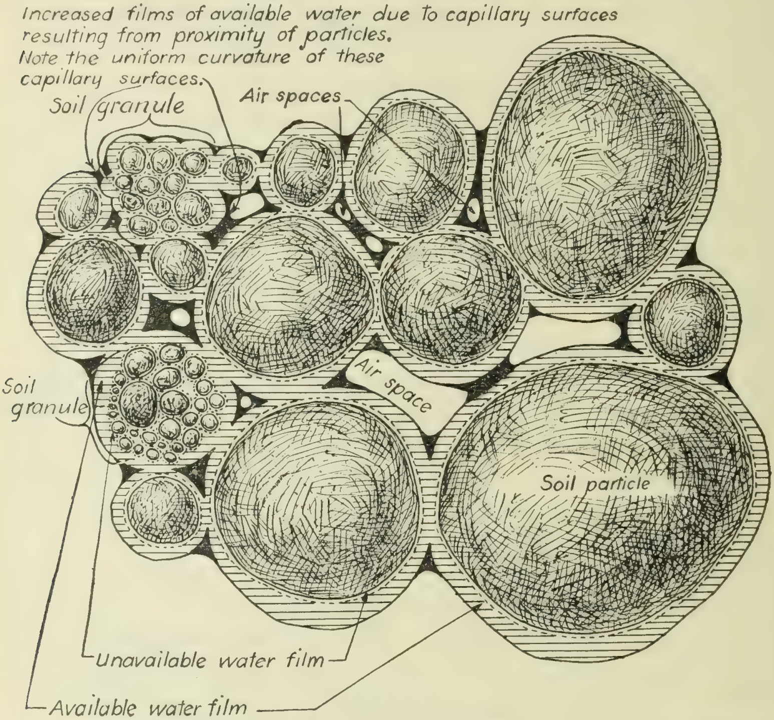
Increased films of available water due to capillary surfaces resulting from proximity of particles. Note the uniform curvature of these capillary surfaces.
Soil granule
Air spaces
Air space
Soil granule
Soil particle
Unavailable water film
Available water film

FIG. 139.— *Diagram representing the retention of capillary water by soil particles, and the influence of their size and arrangement on the amount retained. Note the uniform thickness of films on particles of all sizes where they are sufficiently separated. The black areas represent the increased thickness of the films due to the capillary surfaces where the particles are near enough for the water films to join. On each particle is a thin film of water unavailable to plants. Water in the interior of granules is largely unavailable*

It is especially important that these soils be loose and granular. The finer the soil, the greater should be the effort to put it in a granular condition. In coarse sand soils, the individual particles may rest close together and yet the spaces be too large to be fully effective. On the other hand, in fine clay, if it is pulverized so that the individual particles rest close together, the spaces are so small that they incline to remain full of water, thus cutting off ventilation and preventing the penetration of roots. This condition is further aggravated by the ease with which such a soil is puddled, thereby further reducing the size of the spaces. The water films do not have opportunity to attain their maximum thickness, and the water that is held is so close to the surface of the soil particles that it is largely unavailable to the roots of plants.

The correction for this consists in creating a granular, or flocculated, condition of the soil, so that a number of small particles act together like a single larger particle. *Granulation is important.* The most effective size of granule ranges from the size of corn kernels to that of timothy seed. Inevitably there will be considerable finer material, so that the mass will have a loamy structure.

By loosening the soil, opportunity is given for the maximum thickness of films and the largest proportion of available water.

In a soil that is too fine and compact, the development of the granular condition is accomplished by a number of processes, as is explained in Reading-Course Lesson No. 42, page 166.

Fundamental to all of these is good drainage. The surface soil can be improved to a large extent by tillage coupled with moderate drainage; but the subsoil, to the ideal depth of three feet or more, can be improved only by natural processes, at the basis of which is such a degree of drainage as will permit the removal of any free water so that drying and shrinkage is possible. This change in the physical condition of the soil is the basis of the statement frequently made, that drainage increases the available water capacity of the soil. In addition it admits air, which permits plant roots and various forms of animal life, such as earthworms, to penetrate deep into the soil, and these further aid in the process of granulation.

The use of lime where it is deficient, and the generous introduction of humus, are also effective aids to granulation; and a further benefit from the presence of humus is its own large capacity to hold water, as is illustrated by muck soil.

When clay or other puddled soil is plowed, it is likely to break up into large lumps. This is a form of granulation, but, as in sand and gravel, the lumps are too large and must be reduced in size by pulverizing.

Between these two extremes of soils — those that are too loose and those that are too compact to have the maximum ability to hold available water — is every gradation of condition. The intermediate soils, such as sandy loams, loams, and silt loams, are easier to manipulate and are adapted to the widest range of crops and farm practices. The farmer must always use his judgment as to the particular treatment his soil needs, having in mind its present condition, the desired change, and the attendant seasonal conditions and crop requirements.

Free, or hydrostatic, water

Film water is the only form of soil moisture used directly by crops. When the films have reached the maximum thickness, the soil has all the water that it can retain and this quantity will be permanently held in the soil. It cannot be removed by drainage. If, however, the large spaces are filled with water beyond the range of the films, this added water is not held by capillary force and is free to pass downward under the influence of gravity unless the lower part of the soil is impervious. This free water is termed hydrostatic water, and is the part of the soil moisture that is removed by drainage. The height to which the large spaces are filled with water is called the water-table; its presence excludes air, and thereby repels the growth of roots of all the common crops that are not adapted to grow in saturated soil. Drainage aims to lower the water-table so as to give a suitable root zone, which should be at least three feet in depth.

LOSS OF WATER FROM SOIL

It is well known that crops frequently suffer from the lack of available water. From the above discussion it is evident that the difficulty is not with the water supply relative to the quantity used by crops. Nor is it due to the complete inability of the soil to retain enough of the precipitation to meet the needs of plants. It must therefore be due either to the fact that the soil is not in condition to absorb the precipitation, or to loss after the water has been absorbed. We have pointed out the ways in which the capacity of the soil to absorb and hold water in available form may be increased. It now remains to consider the ways in which water is lost from the soil.

It is evident from what has been said that when the soil has taken on the maximum films of water, any excess is properly permitted to drain away out of the root zone.

Growth of weeds

Film water can be lost only by evaporation. Its removal by evaporation from the leaves of the crop is essential and must be provided for. Its waste by evaporation from the leaves of weed plants is to be avoided by their destruction. The destruction of weeds is one important reason for tillage. The larger the weed plant and the deeper its root system relative to the regular crop, the more injurious is its growth likely to be by the exhaustion of the water supply. Since the water supply also measures the solution and transfer of plant-food from the soil to the plant, it is evident that weeds interfere with the nutrition of the crop as well as with its water supply. By expanding the evaporating surface, weed plants greatly increase the loss over what it would be directly from the soil.

Evaporation from the soil

The phenomenon of the evaporation of water from a moist soil is a common one. If a soil were kept well moist throughout the year, the total amount of water that would evaporate would be sixty or seventy inches — which is more than would evaporate from a water surface because the wet area is increased by the uneven surface of the soil. This illustrates the large possible waste of water if some provision is not made for its conservation. Under average field conditions, the loss of water by evaporation is not so large as the figures just given; but it does account for the difference between the fifteen or twenty inches of water that plants may use and the three, four, or five inches that they actually do use in their growth. One of the big problems of the farmer is to prevent this useless and expensive loss of water by evaporation from the soil.

Mechanism of evaporation

In the process of evaporation, very small particles of water become detached from the main mass and float off in the atmosphere. They are detached by their vigorous vibration at the surface of the water, which is increased as the temperature increases. Consequently, if other conditions are equal, the warmer the water the more rapid is evaporation.

The detached particles of water move about promiscuously in all directions in the atmosphere and are said to diffuse through the atmosphere. Some of them find their way back to the surface of the soil. If the soil were absolutely dry, the contact of these moisture particles with it would make its surface somewhat moist. All objects, including the dusty-dry soil, carry a certain quantity of such *moisture of condensation*, termed *hygroscopic moisture*. The quantity of water taken up by a soil in this way is never enough to support the growth of crops, although it probably is helpful to the growth of bacteria, which are exceedingly small plants. From the last statement it is evident that the common belief that a compacted soil which becomes moist derives its moisture from the air, is wrong, and that this fact must be accounted for in another way. The moisture that appears in a footprint in a dry soil comes from below, not from the air, in accordance with laws that will be further explained in this lesson.

If the particles of water that are detached from the moist soil are free to move away in the atmosphere, the loss will continue as long as moisture is available. The warmer and drier the air, the more rapid is the loss of water. Winds that hasten the movement of the particles of moisture and bring a new supply of dry air in contact with the moist soil greatly increase the loss. This is the basis of the common statement that winds have a very drying effect.

On the other hand, if the volume of air in contact with the soil is limited and relatively small — say a layer a few inches, or perhaps a few feet, in thickness — there will come a time when no more particles of water can be taken up. Physicists explain this stage as due to the fact that as many particles drop back into the liquid as pass out into the air. An equilibrium is established and the atmosphere is saturated; hence loss of water stops. That is what occurs when a lid is placed over a pail of water or when a box is turned over a block of moist soil.

Mulches

There are various ways of covering a soil in order to stop loss of water by evaporation. One method is to cover the soil with boards. Stones serve the same purpose, and where other means were not practicable stones have sometimes been hauled on the soil to form such a cover. Soils that are very stony at the top have been observed to hold moisture well, and the removal of the stone has resulted in less growth of crops. Another method is to cover the ground with a mulch of straw or leaves. There is a method of growing potatoes by which the tubers are placed on the surface of the ground and deeply covered with straw. The potatoes grow, and may reach a satisfactory maturity. The straw holds the moisture in the soil to the very surface, so that the roots may develop and find their way into the soil for sustenance. A layer of coarse sand or gravel serves the same purpose, and even a very dry layer of finely pulverized soil may be placed on a moist soil and will prevent the evaporation of moisture in the same way because it forms a cover.

However, all these methods of covering the soil in order to save water are impracticable except on a very small scale. For the average farm it is necessary to make the cover out of the natural soil. It is well known that such a cover, consisting of a layer of fine, dry soil, is effective to prevent evaporation. It is called a dust mulch, dust blanket, soil mulch, or dust cover.

Simple rules can be given for the general management of the soil in order to secure and maintain a mulch. These rules usually involve the frequent stirring of the topsoil as soon after a rain as is possible without puddling the soil. The stirring should be repeated as often as the topsoil has become moist and caked; this condition indicates that it has largely lost its efficiency as a mulch.

Management of the dust mulch.— In order to understand the reasons for the effective management of a mulch, as well as to be best able to decide the particular treatment to be given, it is essential to understand the principles involved. Throughout New York, where there is a generous rainfall, the mulch must be made from the moist soil.

Dry soil acts as a mulch because when dry it tends to remain so and does not readily take on a new water film. There are in every soil organic substances of a fatty or greasy nature, and when once the soil becomes dry these form a coating on the particles which offers some resistance to the absorption of water. Further, when a soil is dry, moisture creeps over its surface very slowly, especially if the adjacent soil is only moderately moist. Any treatment that causes the topsoil to become dry forms of it a mulch. It is not even necessary that the mulch be loose if only it is dry, but in practice looseness is necessary in order to quickly secure a dry condition.

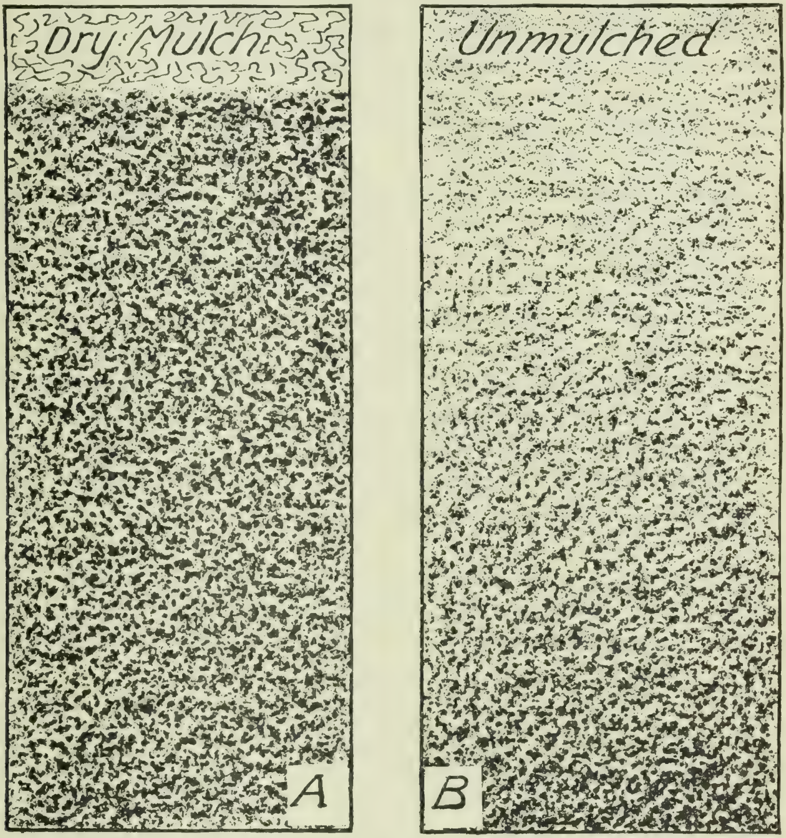

FIG. 140.— *Diagram representing the relative distribution of moisture in two sections of soil receiving different treatment: A, covered by dust mulch, moisture is abundant up to the under surface of the mulch; B, without mulch, soil is dry to a considerable depth*

In the field a mulch is naturally formed in the following way: As soon as rain ceases and the atmosphere becomes somewhat dry, evaporation begins from the surface of the wet soil. As evaporation proceeds and the topsoil becomes less moist than the soil below, moisture moves up from the adjacent layer to partially replenish the loss. If, however, evaporation is more rapid than the rate of movement of water into the surface inch or two of soil, that soil will gradually become dry. The dryer it becomes, the slower is the movement upward from below; so that the more rapidly the soil becomes dry, the more rapidly is the mulch developed by which the water in the underlying soil is protected. If the atmosphere is very dry and warm, the mulch may quickly form naturally without the loss of water from more than a few inches of the topsoil. This is what happens after an application of water to the soil in arid regions. In humid regions such as New York, however, the atmospheric conditions much of the time, and especially just after a rain, are favorable for slow evaporation which may very slightly exceed the movement from below. Hence the topsoil will remain moist for a long time — several days or weeks — and the loss of water may extend several feet into the soil. Eventually a very deep mulch would be formed, but the loss of water in the process is very great. Another rain may come in the meantime so that the soil is kept almost continuously in condition for the loss of water. Further, the moisture condition of the atmosphere varies. One day of a very drying atmosphere may be followed by a damp, muggy day in which the movement of water from the subsoil almost or quite equals the loss of the two days. This contributes to the waste of water.

By cultivating the top layer of soil its structure is loosened so that evaporation from that part is hastened. The loosening also reduces its contact with the moist soil below, so that less moisture is absorbed. Hence cultivation greatly promotes the formation of a mulch.

It should be understood that the absorption of moisture by the mulch never entirely ceases, although it becomes very small. Even after the topsoil is approximately dry, a period of very moist atmosphere, such as accompanies foggy or very cloudy weather, may permit the absorption of moisture from the subsoil to partially destroy the mulch, so that if a period of drying weather follows the total loss of water may be considerable.

From these facts it is evident (1) that tillage usually aids in the formation of a mulch; (2) that the mulch should be as shallow as is practicable in order that the least amount of water may be lost in its formation; and (3) that when once the mulch is dry further tillage is of no advantage as long as it remains essentially dry, but should the mulch become moist and form a crust further tillage is beneficial.

Sandy soils are easier to mulch and to maintain in a mulched condition than are clay soils, because the drying is more rapid and the absorption from below is slower. Normally, if evaporation continues at the surface of the soil, moisture will be lost to a depth of two or three feet as a result of the process of equalization by capillary movement from below. In those soils that crack seriously the loss from the subsoil is increased by evaporation into the air in these cracks, from which the moisture rapidly diffuses or is sucked out by winds passing over the surface. Clay and muck soils are most inclined to form large cracks, and it is especially important to keep these cracks sifted full of dry soil in order to reduce the loss of water from the subsoil.

Depth of soil mulch.— The use of a soil mulch is practicable for all tilled crops. The depth of mulch that is adequate to prevent a large part of the loss by evaporation may be one half inch to two or three inches. A half, or even a quarter, of an inch of fine, dry soil will reduce evaporation to seventy-five to ninety per cent of the loss without a mulch. As indicated above, the climatic conditions have much to do with the efficiency of a mulch, and in general a mulch is not so effective in the humid climate of the Eastern States as in the arid climate of the Western States. It has, however, been demonstrated many times that the saving of water by thorough mulching may make the difference between a full crop of corn and a half crop or a complete failure. In orchard management, tillage, with the consequent mulching, has much to do with the better growth of fruit, as compared with grass crops. That mulching is an effective means to prevent loss of soil moisture, and that sufficient water can be stored in the soil to meet the needs of crops, is abundantly shown by experience in the arid and semi-arid sections of the country. Where water is available for irrigation only in the winter, as in parts of the Northwest, full crops are produced without any rainfall or application of water during the crop season. On the eastern slope of the Rocky Mountains, where the rainfall in one season is often not adequate to produce a good crop and irrigation is not practiced, the rainfall of two seasons is stored in the soil and held by a mulch, to be used in producing a crop in alternate years.

In sandy loam or other soils where a good tilth is easily maintained, a mulch of a half inch to an inch in depth is entirely practicable. Implements having many small shovels or an equipment of horizontal blades are essential in order to do good work of this sort. (Reading-Course Lesson No. 42, Fig. 99, page 177.) In clay soil inclined to be cloddy, a somewhat deeper mulch, of one and one half to three inches, must usually be maintained in order to get sufficient fine earth to be effective. About two inches is the depth found to give best results on such soil. Clods a half inch or more in diameter do not form an effective mulch unless it is two or three inches thick.

Distribution of soil moisture under a mulch.— Where no mulch is established the soil is likely to be relatively dry for a considerable depth. Plant roots do not find favorable conditions to get either moisture or plant-food in that part of the soil section, and a large part of it is ineffective. On the other hand, in a well-mulched soil abundant moisture occurs, up to the very base of the mulch, and roots are able to utilize almost the entire soil section.

Mulching crops that are not tilled.— Many crops are not tilled so that the dust mulch is not applicable. The treatment here must be even more deep-seated. It is especially important that such plants be able to establish and maintain their roots deep in the soil. Thorough drainage is therefore very essential. In arid sections grain crops are sometimes cultivated. Provided the cultivation begins when the plants are very small, it may be continued without serious damage until the heads begin to form.

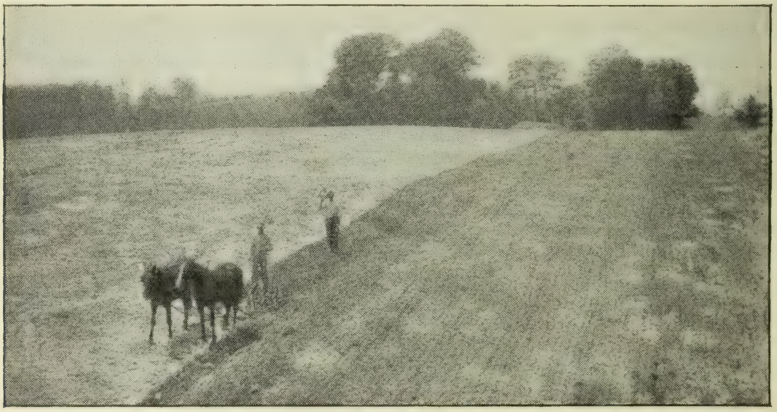

FIG. 141.— *Making a dry mulch by the use of a spring-tooth harrow*

There is opportunity for benefit by the use of available manure as a top-dressing and mulch on the grain and the new grassland. Especially is this desirable when grain is used as a nurse crop for grass. When the nurse crop is removed in midsummer, the grass plants are weak and the soil is exposed to rapid drying, both of which conditions are hard on the grass plant. The manure forms a mulch as well as affords a generous food supply; and the practice, which is becoming common in New York, is shown to give good return in the succeeding crops of hay and grain. After a crop has reached the size at which it effectively shades the ground and holds the air in place near the soil so that it becomes saturated with moisture, the loss by evaporation from the soil is much reduced, except when heavy winds occur that suck out this moist air and replace it with dry air — which process cannot be controlled to any extent. Windbreaks afford some protection.

MOVEMENT OF WATER IN THE SOIL

It has been pointed out that the soil water on which plants depend is held in the form of films on the soil particles, and that these films exist in a state of tension. The tension is due to the curvature of the water surfaces in the necks between the soil particles. When a moist soil has stood for a long time without any loss, the moisture should be uniformly distributed over the particles throughout the mass, except that the films are thicker at the bottom than at the top of the section due to the pull of gravity on the water. This modifies, but does not overcome, the capillary, or curvature, pull. If a sand and a clay soil are in contact, each will take the same thickness of film on its surface. The amount of moisture required for the same thickness of film on two soils of different fineness is called the *moisture equivalent.* Two soils of different texture have come to their moisture equivalent when the same plant wilts on each soil under the same atmospheric conditions. Two soils having the same thickness of film, whether that thickness be great or small, will appear equally moist, although in each unit volume one soil may actually hold twice as much water as the other.

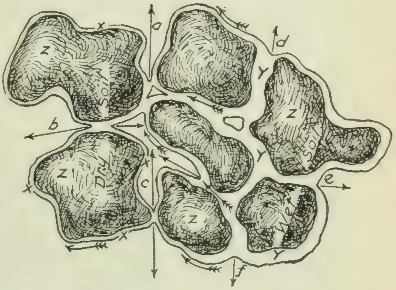

Fig. 142.— *Diagram illustrating unequal distribution of capillary water in a mass of soil. Where the film is thick* (y) *the curves are flat and exert a small pull, as at d, e, and f. Where the films are thin* (x) *the surface curves form acute angles and therefore exert a large pull, as indicated by the length of the arrows at a, b, and c. The direction of movement of water is indicated by the feathered arrows*

If for any reason the films of water are thinner in one part of the soil mass than in the adjacent soil, the greater curvature of the surface of the films in that part will draw in water from the wetter part. This adjustment will take place for an indifferent distance in all directions. For example, if water evaporates at the surface of the soil, the moisture would be drawn up from the subsoil. As plant roots use the water in contact with their surfaces, water moves in — drawn by capillarity — from the more remote, but wetter, particles. It is a general principle that water in the soil moves from the place where the films are thick to the place where they are thin. Any change in the structure of a moist soil that alters the relative thickness of the films in the different parts of the mass will start movement of the moisture to bring about equilibrium.

Some treatments that influence the capillary movement of moisture

Use is made of this principle of capillary, or film, movement of water. For example, when the soil is relatively dry and a rain occurs, capillarity helps to pull the water into the soil. As the upper soil drys out, capillarity returns water to the surface. It draws moisture to meet the roots advancing through the soil. When the farmer plants very small seeds on the surface of a dry soil, it is customary to use a roller, which packs the top-soil thereby increasing its capillary pull so that moisture is drawn up from below to germinate the seed. When very dry land is plowed it is sometimes packed in order to *draw moisture* from the subsoil. When the immediate surface is left loose the operation is called subsurface packing, for which purpose special implements have been devised. In many ways the farmer makes use of the principle of capillary movement and many of his tillage operations are designed to effect capillarity. It is involved in the production of a mulch, as explained above.

Sometimes the addition of a small quantity of water to the soil may prove harmful because of this film movement. As has been pointed out, when the soil is relatively dry, movement is very slow. If a small quantity of water is added, either by a shower of rain or by artificial application, it is sufficient to reestablish rapid capillary movement without causing deeper penetration. Evaporation is hastened. All the water applied is lost, and before the process ceases further quantities of water will be removed. Small rains are therefore usually injurious, for they add nothing permanent to the soil and necessitate the reestablishment of the mulch. The common practice of adding a little water to lawns is to be condemned for this reason. When an application is made it should be sufficient to penetrate considerably below the mulch layer. This usually requires one or two inches of water.

Rate of capillary movement

While differences in the distribution of water in a soil will adjust themselves over considerable distances, the rate of movement may be so slow as to make the process of little value. The particles of water must move through the thin films. When the films are reduced so that they are very thin, the friction against the surface of the soil particles is so great that it stops movement for all practical purposes. This is why plants wilt in soil that appears moist. When the films are thick the outer particles of water are quite free to move and adjustment is rapid. In a puddled clay soil that may be wet to the point of stickiness, the water moves with extreme difficulty because all the films are very thin, due to the extreme fineness of the particles and the very small size of the spaces. In a granulated soil the films in the large spaces are able to become thick and thereby movement is much freer. Because of these extreme possible differences, the tilth of clay soil is particularly important and puddling is especially to be avoided.

SOME PRACTICES THAT AFFECT SOIL MOISTURE

A few common farm practices may be discussed in their relation to the conservation of soil moisture:

Ridge versus level culture.— For the conservation of soil moisture, level cultivation is now universally recognized as the best practice. Ridges increase the surface exposed to evaporation, and they also increase the difficulty of maintaining a good mulch. Even potatoes are now generally cultivated level, and with better results in the long run than follows ridge culture.

Early spring plowing.— In spring the soil is generally saturated with capillary water, if not also with free, or hydrostatic, water. The atmosphere is moist, although dry enough to permit fairly rapid evaporation; and after the soil is dry enough to till, any delay may occasion the loss of an inch or more of water each week. This quantity would make the difference between a large and a small crop. Land should be plowed as early in spring as possible, and if it cannot be plowed it is sometimes practicable to partially mulch the surface by disking or harrowing.

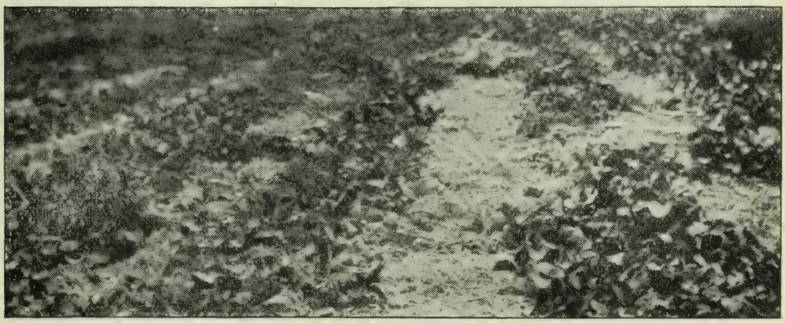

FIG. 143.— *A mulch of straw, such as is frequently used on land devoted to small fruits*

Early summer and fall plowing.— In the semi-arid regions where both the summer and the winter rainfall must be stored, plowing as soon as the crop has been removed in the early summer and fall is especially important. But in New York, where the soil usually becomes saturated in the winter irrespective of past treatment, early fall plowing is not important; in fact, late fall plowing is preferable because of its relation to soil organisms and the physical condition of the soil.

Where a fall crop is to be planted, plowing as soon as the previous crop is removed, if accompanied by cultivation, may save sufficient moisture to make much difference in the starting of the succeeding crop.

Plowing under green-manure crops.— The drying effect of crops has been pointed out. If a green-manure crop is allowed to stand until late in the spring, it may deplete the soil moisture to such an extent that the succeeding crop will have difficulty in starting, especially if the season be a little dry. After a green-manure crop has commenced to flower, nothing is usually gained from further growth.

SELECTION OF TILLAGE IMPLEMENTS

The selection of tillage implements for the control of soil moisture must be guided by the change in soil structure that is to be made. A large variety of implements are available, all of which may be grouped into a few fundamental types. The two main groups of these are (a) compacters and (b) implements that loosen the soil. Of the latter group plows operate to the greatest depth. Subsoiling is seldom advisable. Deeper plowing is generally advisable, especially if it is joined with the addition of organic matter. Tillage implements are usually selected with reference to the crop and the condition of the soil, in addition to their effect in keeping the surface level.

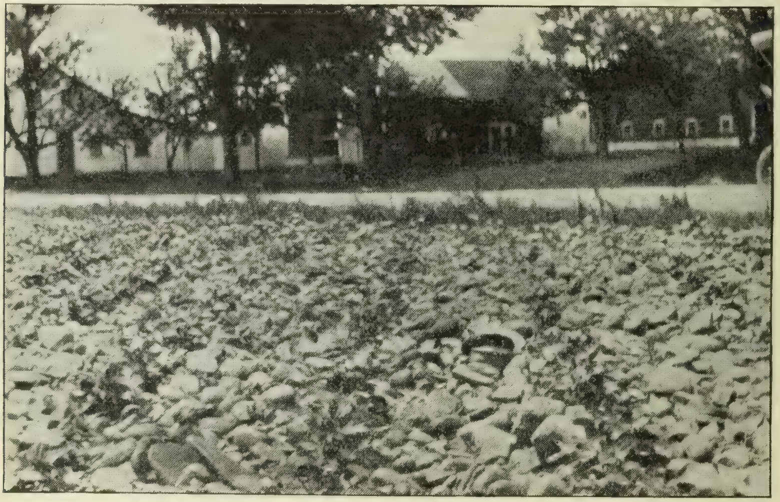

FIG. 144.— *A natural mulch of stone*

CONCLUSIONS

It is clear that for the great majority of New York soils and crops, there is sufficient water supply if it is effectively managed. This is possible to a much larger extent than is now realized. Our climate is subject to rather extended periods of dry weather, as well as of wet weather. The wet periods can be largely offset by drainage. Therefore it is the part of wisdom to manage the soil as if each season were more dry than the normal. If moisture is supplied, growing conditions are better in dry seasons than in wet, dark seasons. In that direction is the largest opportunity for the capable farmer to get results. Irrigation has some place as a supplement to the natural rainfall and storage capacity of some soils, but usually only after better methods of control of soil moisture have proved their inefficiency.

ADVANCED READING

The Reading-Course lessons are designed merely to introduce the subject; they are elementary and brief, and are intended to arouse a desire for more complete knowledge along particular lines. The study of Reading-Course lessons should be introductory to the study of standard agricultural books, and of bulletins of the United States Department of Agriculture and the state experiment stations. The Supervisor of the Reading-Course will suggest, as far as possible, agricultural literature to meet the needs of any reader. Particular books or bulletins are recommended because they are thought to be of special interest to the reader in his individual study, not because they are considered superior to others on the same subject. The following references are suggested for further reading on the subject of this lesson:

Books

Physical properties of the soil. (Chapters II and III.) By R. Warington. Published by The Clarendon Press; may be procured from Charles Scribner's Sons, New York. 1900. $3.

The soil. (Chapters XI, XII, and XIII.) By E. W. Hilgard. The Macmillan Company, New York. 1907. $4.

Dry farming. By J. A. Widtsoe. The Macmillan Company, New York. 1910. $1.50.

Bulletins, United States Department of Agriculture

(These may be obtained from the Superintendent of Documents, Washington, D. C., for a small charge.)

The water requirements of plants. Part I. Investigations in the Great Plains. Bureau of Plant Industry, Bulletin 284.

The water requirements of plants. Part II. Review of literature. Bureau of Plant Industry, Bulletin 285.

The moisture equivalent of soils. Bureau of Soils, Bulletin 45.

Moisture content and physical condition of soils. Bureau of Soils, Bulletin 50.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

B. T. GALLOWAY, *Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 70 AUGUST 15, 1914 **THE SOIL SERIES No. 4**

SOIL MOISTURE AND CROP PRODUCTION

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of bringing out the main points covered and of calling attention to related agricultural facts, practices, or methods. The College encourages an expression of opinion or a statement of experience by means of the questions asked. Each discussion paper filled out and returned will be read carefully, and a personal reply will be made if agricultural information is desired regarding personal or community problems or the subject studied.

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(In answering questions, attach additional paper if needed and number the answers.)

1. How does the quantity of water actually used by crops compare with the precipitation in New York?

2. Since the precipitation comes periodically, what is the capacity of soils to retain sufficient available water to tide plants over the dry periods?

3. In what ways is water held in the soil? Explain.

4. Which forms of water in the soil are available to plants and which forms are unavailable or injurious? Why?

5. How would you proceed to increase the available water capacity of a coarse, sandy soil? Explain.

6. How would you proceed to increase the available water capacity of a heavy clay soil? Explain.

7. Define the term "mulch," and explain how you would manage a soil planted to potatoes in order to save moisture.

8. How would you manage a soil that had grown a crop of early peas if it were to be succeeded by late cabbage, in order to have the best conditions of soil moisture?

9. Name and explain three practices besides mulching that aid in the conservation of soil moisture.

10. What methods are in use in your region to insure the best use of the precipitation for crop production?

Name..

Address...

Date..

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VOL. III. No. 72 SEPTEMBER 15, 1914 FRUIT-GROWING SERIES No. 6

CULTURE OF THE GRAPE[1]

H. B. KNAPP

The growing of grapes has become an important branch of American horticulture. It is well developed commercially in western and southern New York, in northern Pennsylvania, in Ohio, and in Michigan. The grape should be found in every home garden and on every farm, for home consumption and often as a joint source of revenue with general farm crops or with other fruits.

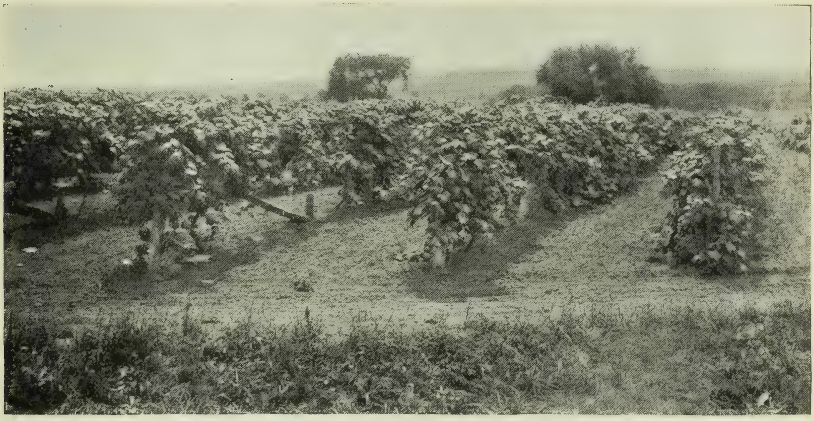

FIG. 145.— *Ready for the sowing of the cover crop*

LOCATION AND SOILS FOR GRAPE CULTURE

The best location for commercial vineyards is along the shore of a lake or a river. Large bodies of water equalize the temperature of the surrounding land, making it warmer in winter and cooler in summer, and affording protection from late spring and early fall frosts. Lands so situated are likely to be steep, however, making cultivation, spraying, and harvesting difficult and expensive. Whenever possible, growers should choose high, fairly level land, with sufficient slope to provide thorough air and surface drainage, but not enough to wash badly in heavy rains. A free circulation of air decreases the danger from frosts and fungous diseases, and reacts very favorably on the general health of the vines.

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[1] The author is indebted to Miss Margaret Connor for assistance in the collection of material for this lesson.

Many growers lay great stress on the importance of a southern or eastern exposure in northern latitudes. While it is well to keep this point in mind when purchasing land for a vineyard, it should not be unduly emphasized, and experience has shown no bad results in the Chautauqua region of New York, where nearly all the vineyards face the north.

The grape will thrive on a wide variety of soils, but for commercial plantations a warm, well-drained, moderately loose and friable soil, whether of loam, sand, or gravel, or of a rocky nature, should be chosen in preference to heavy clay soils. A porous subsoil is also important in order to secure proper drainage, especially if the land contains much clay.

CULTURAL DIRECTIONS

Preparation of the soil

The preparation of the soil is one of the most important operations in establishing a vineyard. If this is well done, the land is more easily cared for in succeeding years and the yields are appreciably larger. The chief object of such preparation should be to get the soil of a uniform nature and a moderate richness throughout. A wet soil is in no sense suited to grape-growing, and such a soil should be thoroughly drained before the vines are set. The initial cost of drainage is high, but a good vineyard, like an orchard, is a lifetime investment. A properly laid system will not need renewal, and no other factor influences the general health of the vines and the size and quality of the crops so greatly as does the condition of the soil.

Sandy, gravelly, and light loamy soils often lack organic materials, which may be supplied in the form of barnyard manure, or by growing clover or a similar crop and turning it under while green. If the soil is poor and manure has to be added, this should be spread evenly over the surface. Compact soils, such as heavy loams or clays, need less organic material but require thorough pulverizing. If the land is in sod it should be used for the growing of a tilled crop during the year previous to planting. Thorough cultivation should be given in order to free the soil of grass and weeds.

Propagation

The grape is propagated very easily. The commercial method of propagation is from hard-wood cuttings. These are taken from the trimmings of the vineyards during the fall or winter pruning. As soon as the vines are pruned, select the well-matured, solid, and short-jointed canes, cutting to three or more buds' length. Tie into small bundles of not more than fifty, and bury to half their depth in damp sand, moss, or sawdust, in a cool cellar. By spring the cut surface will have callused, and the slips are then planted in nursery rows in loose, loamy soil, well and deeply prepared. Only the upper bud is left at the surface. Cuttings are placed six to eight inches apart in the row, and the rows are far enough apart to permit horse cultivation.

As a rule it will be found most satisfactory to procure the vines from a nurseryman who is making a special business of growing them. Strong one-year vines are better than two-year vines.

Planting

Although it is possible to set the vines in the fall when the soil is in good condition, early spring planting is usually practiced in the North. It should be done just as early as possible. Strong, healthy, first-class vines of one season's growth should be planted; older plants should be used only to save rare varieties, for they are likely to be the second season's growth of what was a cull the year before. Plant the vines in a commercial vineyard eight to ten feet apart each way, giving more space to the stronger-growing varieties than to the weaker ones. If any varieties, such as the Brighton, have imperfect flowers, plant next to them varieties having perfect flowers that bloom simultaneously. Be sure that the rows are perfectly straight, and have the vines straight in the rows. Not only does this look better, but also if the rows are crooked the posts cannot be set in line; the wires composing the trellis will then bind on the posts and cannot be easily tightened.

Before the vines are taken to the field, cut back the roots of the one-year-old plants about one third and shorten the tops to two or three buds. The weaker of these shoots may later be removed. Tie the plants into bundles of as many as there will be vines in each row, arrange them in the order in which they are to be set, and either heel them in in moist sand near where they are to be set or place them in a pail of water in order to avoid drying of the roots. Have each variety separate and correctly labeled.

Before planting, mark off the land in strips eight to ten feet apart, both the length and breadth of the field, and then plow down the lengthwise strips. Wherever possible, plant the rows parallel with the direction of the prevailing winds, so that the wind may blow between rather than against the rows. Many vineyardists save much labor by planting the vines in the dead furrow where this intersects the cross markings. Very little labor is then necessary in order to make the holes. Remove the subsoil to the proper depth and throw in two or three inches of surface soil. Set the vines in the center of the hole, spreading out the roots in every direction, cover the roots with well-pulverized surface soil for two or three inches, and then step into the hole and firm down the earth.

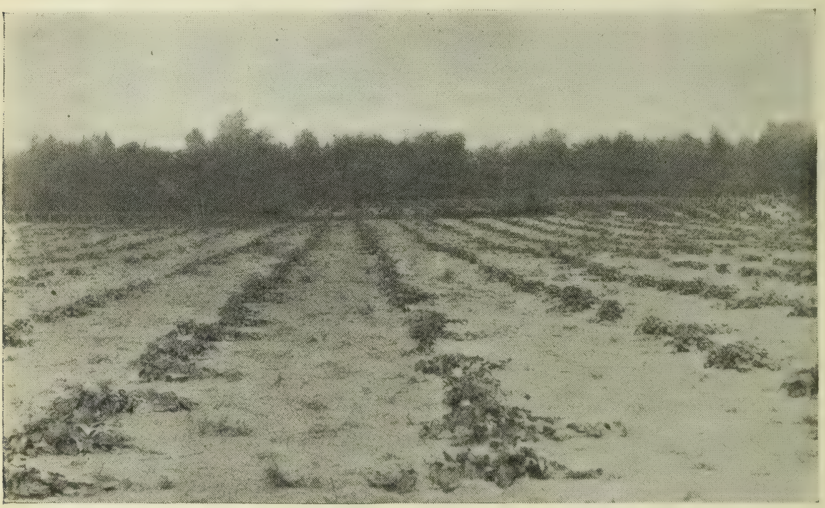

FIG. 146.— *Grape vines one year set*

Most of the filling may be done with a plow, turning a back furrow against the vines, at the same time filling the dead furrow. The ground should be firmed down again and then covered with loose earth to act as a mulch.

Cultivation

Nowhere does clean, careful cultivation pay better than in a vineyard. It should be thorough, extending under the trellis when put up, and working up all the soil in the row.

During the first year of the vineyard, a hoed crop may be planted between the rows, but this adds to the expense of cultivation. It should never be repeated in later seasons.

As the feeding roots of the vine spread in every direction only a few inches below the surface of the soil, cultivation should not be too deep.

When the vineyard is young, the ground should be stirred deeper than in after years in order to force the main roots as far into the soil as possible; otherwise later cultivation may do serious damage. The deepest cultivation should be the first one in the spring, before the roots begin feeding, and should be done with a plow. Level cultivation with a cultivator or a harrow is then necessary, in order to mellow the soil, to allow uniform depth to the roots, and to prevent heavy rains from washing away and gullying the land. Frequent cultivation acts as a stimulant to growth. The grape hoe, or horse hoe, is a very desirable tool for vineyard work, and will save much hoeing by hand if properly operated. Where the land is infested with rootworms, delay the horse-hoeing until

FIG. 147.—*Corn may be grown between the rows the first year, but beans or potatoes are better*

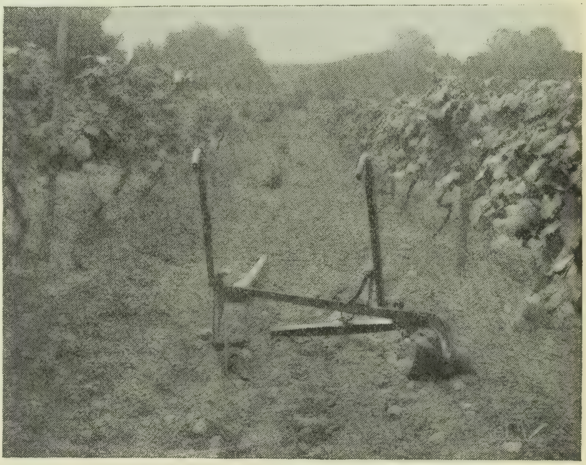

FIG. 148.—*The grape hoe, or "take-out"; inexpensive and efficient*

the middle of June. During the first year cultivation should be especially thorough and should be given both the length and the breadth of the field.

Great care should be exercised never to bruise roots and vines with plow or hoe. Stress should be laid on securing a vigorous and even growth. If this is not obtained in the beginning, years will be required for the vines to recover and sometimes they never reach the uniform standard of a good vineyard.

It is possible to sow a cover crop during the late summer or fall, but the practice is not general in vineyard work. Conditions differ here from those in orchards. We must choose a crop that can be destroyed between the vines, and one with a low growth which will not interfere with picking in the fall. Where crimson clover will catch, it is the best selection. Mammoth clover and vetch are both very good; rye, rape, or cowhorn turnips are possible. Perhaps the best non-leguminous cover crop is buckwheat sown late enough to prevent the formation of seed. The following is the amount of each needed to an acre:

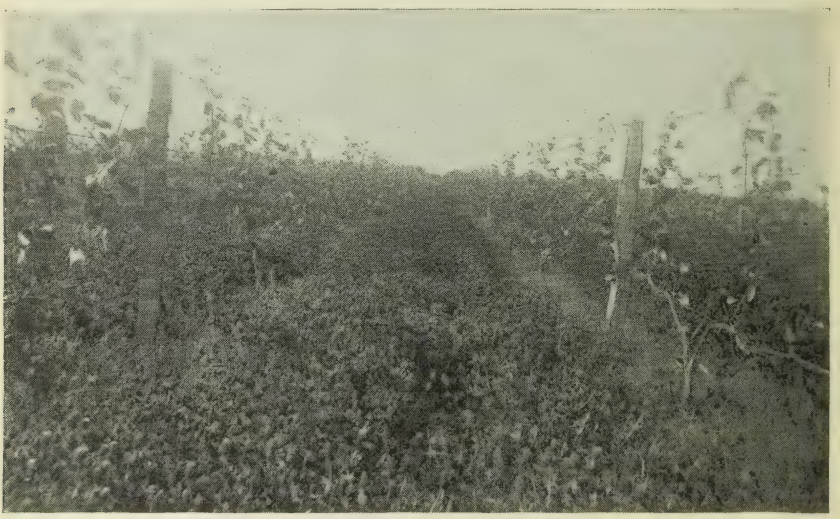

FIG. 149.— *Crimson clover is one of the best cover crops where it will grow*

Crimson clover	15 to 20 pounds
Mammoth clover	12 to 15 pounds
Vetch	30 pounds to 1 bushel
Cowhorn turnips	2 to 3 pounds
Rape	6 to 8 pounds
Buckwheat	1 bushel
Rye	2 bushels

Fertilization

Little experimental work has been done with the problem of fertilization for the grape. There are many different practices and theories concerning this matter, but there is little experimental evidence to justify any of them. The Geneva Experiment Station has recently published the results of a five-years test of fertilizers in seven vineyards in Chautauqua county. The conclusions reached will apply to other sections as well and are incorporated herewith [2]:

1. There has been a decline in yields of grapes in the Chautauqua Grape Belt, the chief grape-growing region of New York. This bulletin is a report of several experiments to determine the value of commercial fertilizers in increasing or restoring former yields.

2. The experiments under discussion were carried on in a leased vineyard near Fredonia, New York, and in six vineyards in various parts of Chautauqua County in which cooperative work was carried on with the owners. The vineyards were selected to obtain fair averages of soils and of health and vigor of the grape plantations of this region.

3. The treatments consisted of annual applications of nitrogen at the rate of from 56 to 72 pounds per acre; phosphorus from 18.3 pounds to 25.3 pounds per acre; potassium from 52.7 to 59.3 pounds per acre; and lime at the rate of 2000 pounds per acre. The nitrogen was applied in nitrate of soda, dried blood, and cottonseed meal, the phosphorus in acid phosphate, and the potassium in sulphate of potash.

4. The results of the experiments are gauged by yield of fruit, effects on the fruit, effects on the foliage, and effects on the wood. A brief summary of the results in the Fredonia vineyard is:

Nitrogenous fertilizers had a marked beneficial effect upon the yield and quality of fruit and upon leaf and wood growth, making it certain that nitrogen is the limiting factor in this vineyard.

Lime had no appreciable effect in this vineyard and phosphorus and potassium had so small a beneficial effect that their use was not profitable.

5. In the cooperative experiments not only commercial fertilizers but stable manure and green manure crops were used. The results from the use of all are confusing and unsatisfactory, varying greatly in any one vineyard or in the several vineyards compared with one another.

6. From the data obtained in these experiments it is evident that the fertilization of vineyards is so involved with other factors that only long continued work will give reliable results. From the work done, however, several suggestions may be made to grape-growers:

First, fertilizers cannot be profitably applied in vineyards poorly drained, suffering from winter freezes or spring frosts, or in which fungi or insects are uncontrolled, or where good care is lacking.

Second, it is probable that most vineyards have a one-sided wear, there being few plantations indeed where more than one or two of the elements of fertility are lacking. Nitrogen is probably most frequently the element needed. Each grape-grower should try to discover which of the food elements his particular soil needs, if any.

Third, maximum profits cannot be obtained in many vineyards of the Chautauqua Belt because of the lack of uniformity in vineyard conditions. Grape-growers should strive by every means possible to secure an equally vigorous and healthy growth over the entire area cropped.

Fourth, the steps to be taken in restoring a failing vineyard are, in the usual order of importance, 1st, give good drainage; 2d, control insects and fungi; 3d, improve the tillage and general care; 4th, apply such fertilizers as may be found lacking.

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[2] A test of commercial fertilizers for grapes. By U. P. Hedrick and F. E. Gladwin. New York (Geneva) Agricultural Experiment Station. Bulletin No. 381.

Pruning

Although possessing apparently such a wild and rambling nature, the grape is really very easily controlled by pruning. Since the best fruit can be produced only on vines that are regularly and systematically pruned, it is important that every vineyardist should understand the fundamental principles on which this operation rests:

(1) Fruit is borne in a few clusters near the base of the growing wood of the present season, which arises from wood of the previous season. Each bud on the old cane produces a shoot which may bear fruit opposite the first two or three leaves formed at its base. The best buds for fruit-bearing shoots are the mature ones at the base of the one-year-old wood, and only as many of these are left at the annual pruning as experience shows the vine should carry.

(2) A vine should bear only a limited number of clusters, say thirty to eighty. Two to six canes of the last season's growth, each bearing five to ten buds, are left at the winter pruning. An average of two clusters may be reckoned to a shoot; therefore, if the vine is strong enough to bear sixty clusters, thirty good buds should be left. The capability of a vine varies with the variety, distance between vines, strength of the soil, age and size of the vine, and system of pruning.

(3) Since the bearing wood springs from new canes, it follows that the fruit is each year borne farther from the main trunk of the vine. Pruning should aim, therefore, to keep the bearing wood as near the original trunk as possible, and every system of training must practice renewal in some form.

Grapes may be pruned at any time during the dormant season. In case the wood is to be used for propagation, it is better to take it before it has been severely frozen. In order to prevent bleeding, which may or may not be injurious, pruning should cease six weeks before the time at which the buds usually swell. Summer pruning should not be practiced save to pinch off or rub out weak and useless laterals and shoots. At planting the vine is cut back to two or three buds and the roots are well shortened, in order not only to render them more convenient for planting, but also to incite the main roots to throw out branching fibers from their ends as well as their sides. If all the buds start, the strongest one or two are allowed to grow, the rest being rubbed off. These young canes may be staked, but they are usually allowed to lie on the ground during the first year. In the dormant season all the canes but one are cut off, and this one is cut back to two or three buds as before. The vine is, therefore, no larger at the expiration of a year's growth than when planted, but it has become thoroughly established in the soil and the second year's growth should be strong enough to form the basis for the permanent trunk. If not, it may be cut back as before for another year. After growth begins in the second spring, one of the strongest shoots should be allowed to remain and this should be grown to a single cane throughout the second summer. At the end of the second year the cane may be cut back to the bottom wire of the trellis, if the upright training is to be used. It may be strong enough at this time to be made the permanent trunk of the Kniffin system, but in most cases the trunk is not carried to the top wire until the third year.

There are three general types of training: the upright, the drooping, and the horizontal, so named from the direction of growth of the bearing shoots. The first and the second are those commonly employed in the North. The upright type, which includes the Chautauqua and High Renewal systems, carries the trunk to the lowest wire of the trellis, two horizontal arms are carried along this wire, and the bearing shoots are tied as they grow to the wires above. These systems keep the top of the vine near the roots, which especially adapts them to small or weak growers.

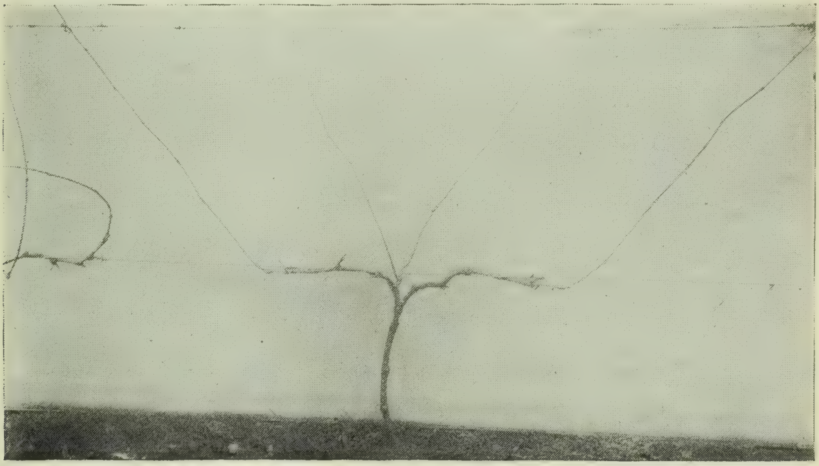

FIG. 150.— *A vine pruned according to the Chautauqua system and tied*

In the Chautauqua system the two horizontal branches are permanent arms and are kept very short. Only two or three canes are taken out from each arm and tied to the upper wire. These upright canes are renewed each year from shoots that spring from their base, or from the arm itself. Sometimes one or two other canes are taken out of these arms near the main trunk, the old wood is cut off, and the whole arm is renewed. The advantages urged for this system are the stronger growth insured by so few canes, the small quantity of permanent wood remaining on each vine, and the small amount of damage possible from strong winds. Two wires of No. 9 or No. 10 gauge are stretched on posts for the trellis; the bottom wire is usually placed twenty-eight or thirty-two inches from the ground; the upper wire may be put on later, about two feet above the lower wire.

In the High Renewal system the arms are twenty-four to thirty inches from the ground and the bearing wood is renewed back to the head each year. The plant is set in the spring and is cut back to three or four buds in the following spring, when the two strongest of these buds may be allowed to make canes which are carried up to the lower wire and are trained along it during the summer. The trunk thus becomes Y-shaped. At the close of the second season after planting, the horizontal canes are pruned back to firm wood, and five to eight strong buds are left on each. In the third season upright shoots grow from these buds and are tied to the second wire. As a rule, a three-years-old vine should not be allowed to bear fruit. In the winter following the third season these canes, with their upright growth, are cut off; and each succeeding year the horizontal canes are pruned away, and their place is taken in the following season by two or more shoots, which grew the year before from the Y-shaped part in

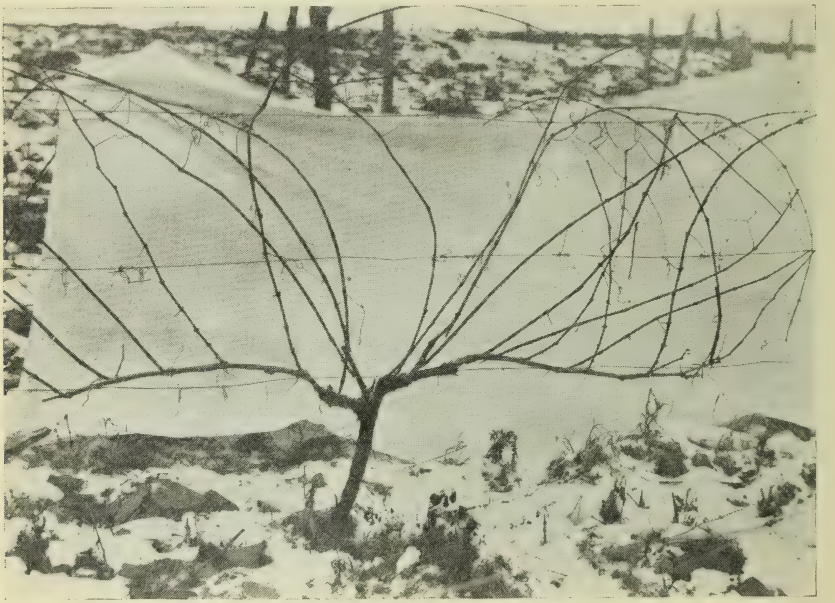

FIG. 151.— *A vine trained according to the High Renewal system before pruning*

the center of the vine. If possible the renewal cane is brought from a new place in the old wood each year in order to avoid a spur. A top will retain its vigor and produce the best fruit for six or eight years, or even longer. After that it becomes large and crooked and is weakened by scars, and the vine should be renewed from the root. The trellis required consists of three wires, the lowest being eighteen to twenty-four or thirty inches from the ground; twenty-four inches is about the right height, but thirty is better than eighteen. The wires are eighteen to twenty inches apart.

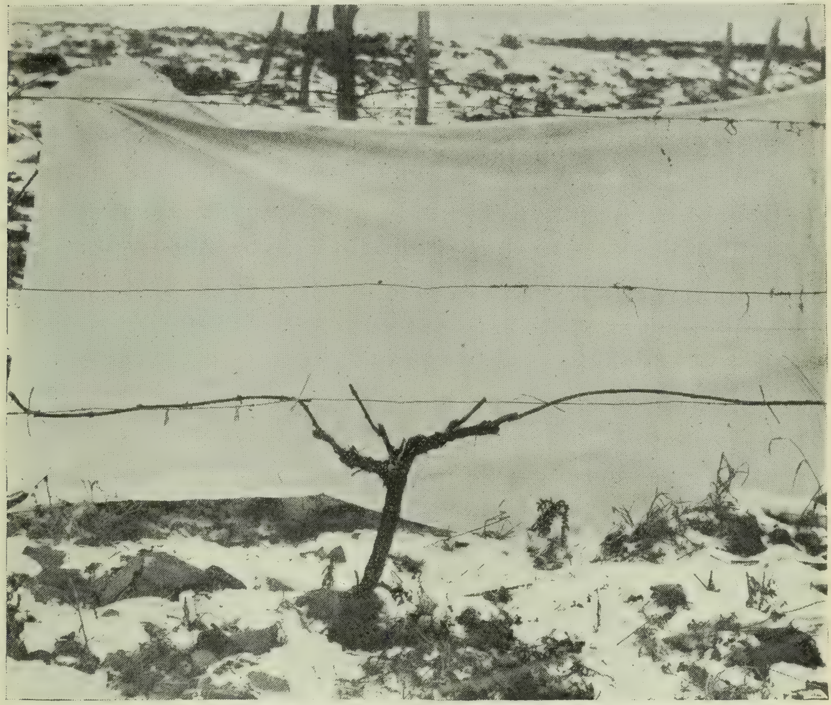

FIG. 152.— *A vine pruned according to the High Renewal system and tied*

The drooping style of training includes the well-known Kniffin system. A single trunk is carried to the top wire and there cut off, and two canes are taken out, from side spurs, at each wire. The main trunk is tied to each wire, the horizontal canes are tied in the spring, and the bearing shoots are allowed to hang at will. Every year all the wood is cut away except a single cane from each side spur, and these spurs are themselves removed every three or four years and new ones are brought out from the main trunk. The system is especially well adapted to strong and drooping varieties, possesses the great advantage of requiring little labor during the growing season, allows of easy cultivation beneath the vines, and permits of a less expensive trellis. The true Kniffin system requires only two wires stretched on posts set between every other vine. For strong-growing varieties the top wire should be about five feet nine inches above the ground; for the Delaware, five feet six inches is the maximum height. The lower wire should be three and one half feet above the ground.

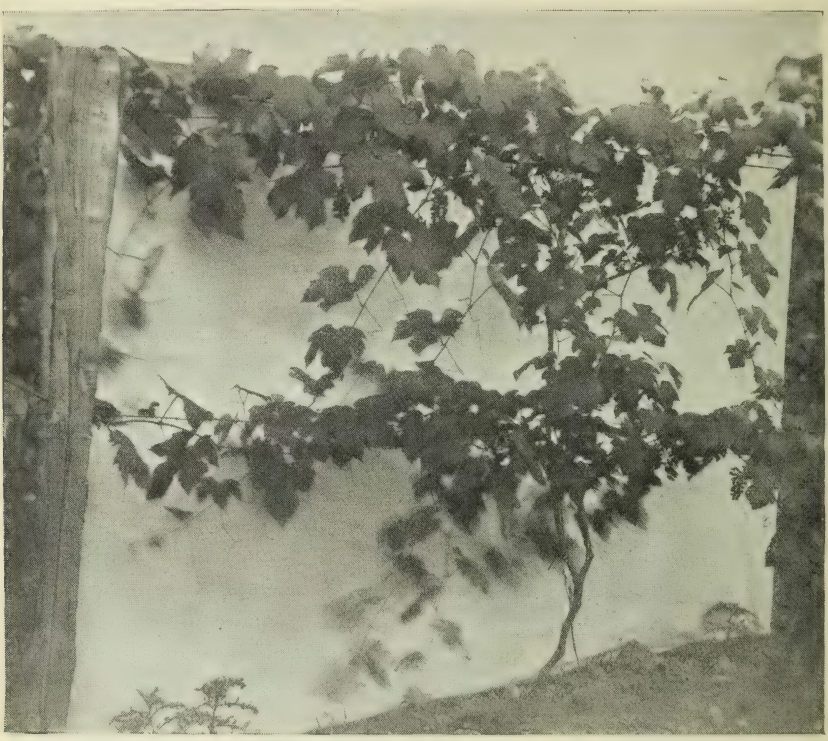

FIG. 153.— *The Kniffin system of training; easy, inexpensive, and satisfactory where winds are not too strong*

Harvesting

Successful vineyardists make preparation during the summer for the harvesting and marketing of their crops, since there is no time later for proper attention to details. Engage expert pickers and packers — the former generally men, the latter women; provide plenty of packing room; improve home-storage facilities; lay in supplies of picking shears, of picking trays holding twenty-five to thirty pounds each, of baskets in which to market the fruit, of labels, stencils, tags, and other supplies. Baskets are commonly of two sizes, one containing about four pounds and the other holding eight pounds. All packages should be uniform, clean, and well and neatly made, and the tops securely fastened. The markings should be with a neat rubber stamp, and it pays to have a distinctive trade mark if one is shipping in quantities.

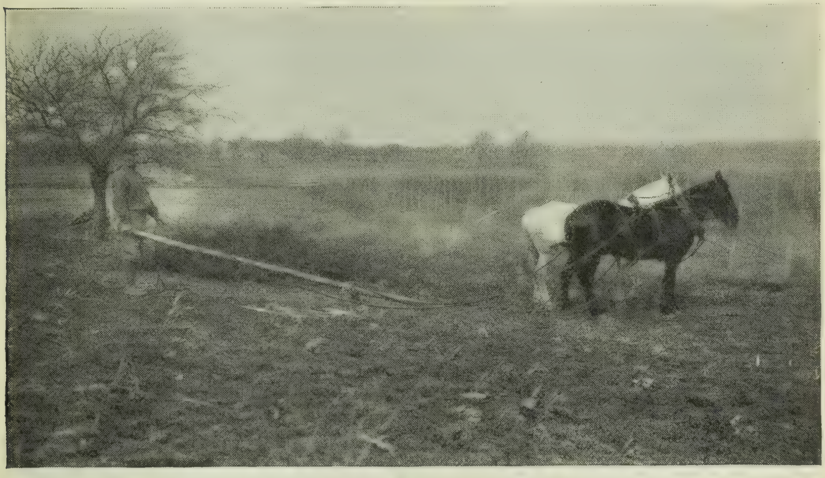

FIG. 154.— *Removing and burning the brush*

Grapes should be gathered only in fair weather after the dew has dried off, and only by experts who can tell when they have reached the proper stage of ripeness. Unfortunately nearly all varieties change color fifteen or twenty days before they are fully matured, and as a result many grapes

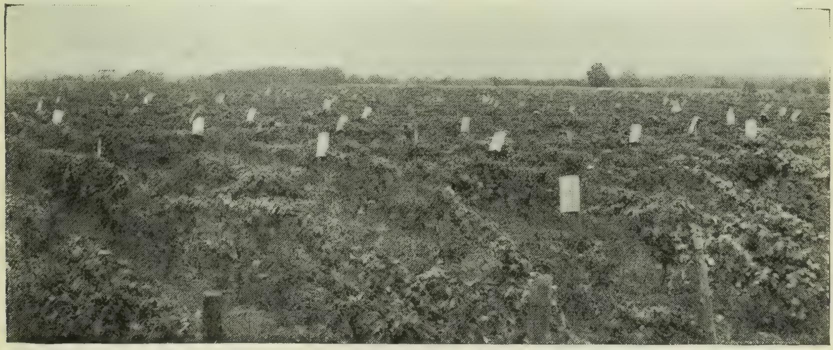

FIG. 155.— *Trays distributed in preparation for the harvest*

reach the market before they are ripe. The stem of the bunch will usually turn brown and become somewhat shriveled when the fruit is ready to pick. The picker grasps the cluster by the stem, which he snips without touching the fruit or injuring the bloom. The cluster is placed carefully in one of the trays, which have been laid ready on the ground along the rows. A spring wagon collects these trays and delivers them at the packing house without jolting. They should be kept away from the direct sun and as cool as possible. Grapes should be allowed to wilt in the grape house until the stems are perfectly dry. Keep the packing house clean and sweet, and the room where the baskets are stored dry and airy so as to prevent mold or mustiness. Packers take up the clusters by the stems, one at a time, and with small pairs of sharp scissors clip out any green or defective berries. They place the bunches compactly and in regular layers in the baskets, so arranged that the lid will require pressing down somewhat. Grapes are usually shipped at once, although many varieties may be kept in storage for several months if the vineyardist desires.

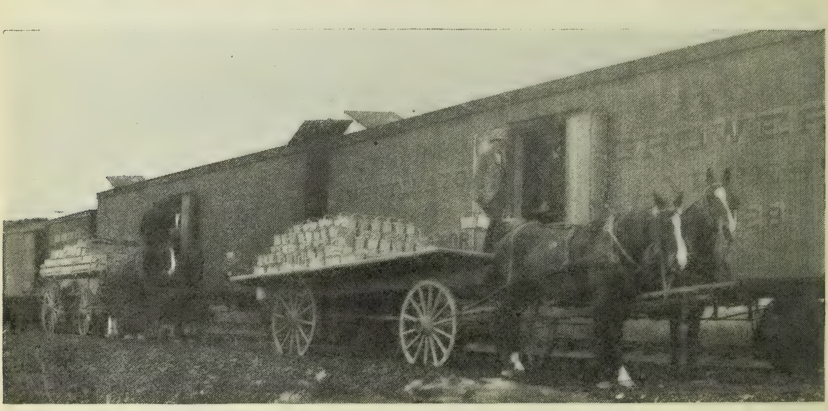

FIG. 156.— *Loading basket grapes*

The advent of the grape-juice factory has been the most important development in New York State grape-growing in recent years. The percentage of the crop used in the manufacture of grape juice is becoming larger each year, and as long as there is competitive buying this tends to buoy up prices and acts as a safety valve when the market conditions are poor. In 1913 more than one half of the crop of the Chautauqua grape belt was consumed by the grape-juice factories, although this is a larger percentage than is used in years of normal crops. The price level year by year is the controlling factor as to new planting, and even as to the care of vineyards, and it would be a serious blow to New York grape-growers if the grape-juice interests should combine for the purpose of controlling prices. It is an open question as to how long the situation will remain as it now is in this respect, unless the growers combine in the interest of better packing and distribution.

Winter protection

In the sections where the fruit is grown in a commercial way, the grape needs no winter protection. In the colder sections, however, as northern New York and among the hills of the southern tier of counties, the vine should be released from the trellis in the fall and allowed to lie directly on the ground in order that the snow may drift over it. If further protection is deemed necessary, it may be lightly covered with clean earth. The soil should be removed in early spring.

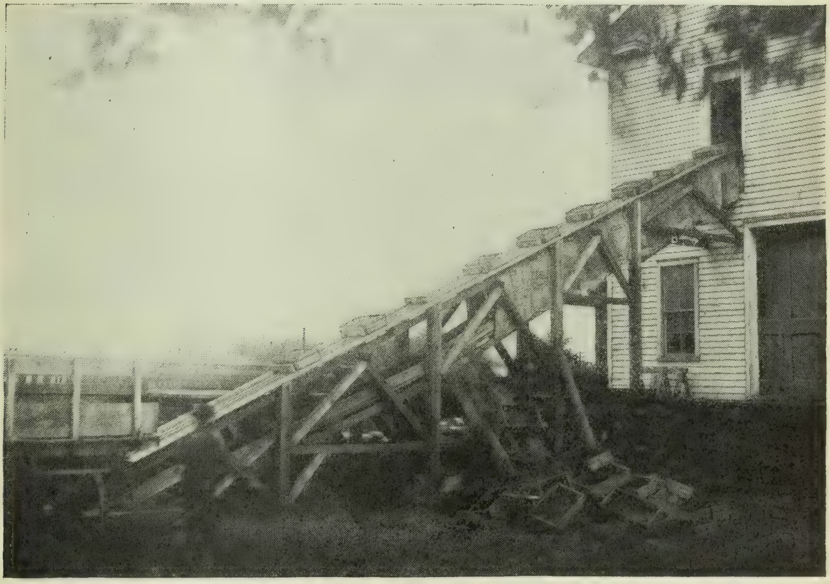

FIG. 157.— *Unloading at the grape-juice factory*

Bagging

Growers claim to secure several advantages, such as the following, by enclosing the fruit in thin manila sacks soon after the berries are set: (1) Protection from mechanical injury, such as is inflicted by birds or by bees, wasps, and other insects, or by spraying and cultivating implements; moreover, the rubbing of the leaves, which causes black spots, is avoided. When perfect table grapes are desired, such protection is very important. (2) Protection from frosts. The warmth afforded by the bag lessens the damage that often results from early frosts in the North. (3) Protection from rot and mildew. Recent experiments show that bagging does not afford protection from these diseases as was formerly thought. (4) Delay of maturity, or ripening. This is the most important advantage gained. All the bunches are of the same color, and the picking, packing, and marketing seasons are distributed over a longer period.

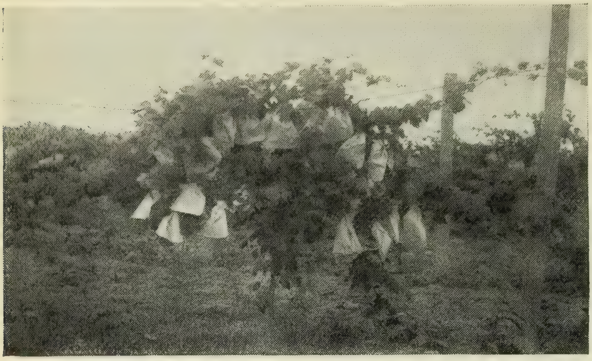

FIG. 158.— *A vine with clusters bagged*

Two or three small holes should be made in the bottom in order to allow any water entering at the top to drain out. The bag should be large enough to allow for the full development of the fruit; the two-pound size is commonly used and is about right. Draw the top of the bag together, fold it over the stem of the vine, turn over, and pin. The bag should be left until the grapes are fully ripe.

In growing fruit for a special market, the bagging of the clusters should prove worth while.

VARIETIES

The ideal bunch of grapes is one that is of medium size for the variety, compact, uniformly developed, and ripened throughout, containing no small or diseased berries, and with the bloom intact. A very dense or crowded cluster is not desirable, for the berries cannot all develop to the fullest extent and the cluster cannot be easily handled when the fruit is eaten.

Following is a list of the ten most important commercial varieties in order of importance:

Concord
Delaware
Catawba
Niagara
Worden
Moore (Moore Early)
Winchell (Green Mountain)
Campbell (Campbell Early)
Brighton
Diamond (Moore's Diamond)

Following is a list of varieties recommended for the home garden:

- Barry (black)
- Catawba (red)
- Colerain (green)
- Concord (black)
- Cottage (black)
- Delaware (red)
- Diamond (green)
- Downing (black)
- Dutchess (green)
- Empire (Empire State) (green)
- Herbert (black)
- Iona (red)
- Kensington (green)
- Pocklington (green)
- Salem (red)
- Winchell (green)
- Worden (black)

(In the colder sections of the State where the growing season is short, Moore and Winchell will be found most satisfactory.)

The following varieties may be recommended for the North for wine grapes:

- Bacchus
- Canada
- Catawba
- Clevener
- Clinton
- Dutchess
- Elvira
- Eumelan
- Iona
- Ives

Among the best of these are Canada, Catawba, Clinton, Dutchess, and Iona.

DISEASES

Black rot

This is the most destructive disease to which our native grapes are subject. The fungus first appears in the spring, on young shoots and on the upper side of the leaves, in the form of small, reddish brown, circular spots, one eighth to one fourth of an inch in diameter. The first appearance on the fruit is as a minute spot around which develops a circular whitish blister. This turns brown and then black, and spreads over the entire berry, which shrivels and hardens. The spores that spread the disease are discharged when the grapes are wet. They remain over the winter, in the berry mummies and diseased leaves left on the vines or on the ground.

Treatment should be in the form of a preventive. All mummies and dead leaves and all prunings from diseased vines should be burned at trimming time. Plow early in the spring, burying fallen mummies and leaves as deeply as possible; follow this by frequent cultivation to keep down the weeds, grass, and water sprouts. Keep the vines off the ground.

Spray thoroughly with bordeaux mixture, 4–4–50: first, when the third or fourth leaf shows; second, when the blossoms are swelling; third, soon after the blossoms fall. If the weather is warm and rains are frequent, spray every week or ten days or before every rain; but in dry weather fewer applications are necessary. Spraying should be discontinued after the first of August. Apply fifty to sixty gallons of spray to the acre; use one hundred and forty pounds pressure, and a nozzle having a one-sixteenth-inch hole in the disk.

Necrosis

Unfortunately the amount of damage that this disease has caused cannot be estimated, for, due to unfamiliarity with the disease, much of its injury has been ascribed to other causes. It is marked by yellowing and crimping of the leaves and dwarfing of the leaves and shoots, especially during the month of June. Minute black pimples are often found on dead wood under the bark, and small, reddish brown spots appear on the green wood. The death of the affected parts and of the vine ensues if the disease is allowed to take its course. It is caused by a microscopic fungus, which lives in the cells of the wood and attacks the sap tubes. The progress of the disease is gradual, often covering years, but when the sap supply is completely cut off from the living tissue the vine dies. Reproduction of the disease is by means of spores found in the small pimples. They may be washed by rain to green wood or to wounds in dead stumps.

Since the fungus is inside the bark, spraying is of no avail except to prevent new infection from spores developed during May and June. A vine once diseased is almost sure to die, and therefore prompt eradication of the affected part or of the whole vine is the best means of control.

INSECTS

Rootworm

This insect has done an immense amount of damage throughout the grape regions of Ohio, New York, and Pennsylvania, and is partially responsible for the recent decline of the grape industry in the Chautauqua and Erie regions of New York State. The adults are small, grayish brown or chocolate-colored beetles. They appear in late June or early July, and eat peculiar chain-line holes into the leaves. Most of the damage is done by the small, white larvæ, which fall to the ground when hatched and feed on the fine, thread-like roots of the vine. In early June of the following season the larvæ form pupal cells a few inches below the surface of the ground.

Cultivate carefully and thoroughly, close up to the vines, in order to kill the pupæ in the soil. Leave the horse-hoeing until the middle of June (the 15th to the 25th), when the pupæ are near the surface. Spray the foliage thoroughly in the latter part of June or when beetles are out, with arsenate of lead, six pounds to one hundred gallons of water, to which one gallon of cheap molasses has been added, if the beetles are numerous; or with bordeaux and lead as a repellent if the beetles are few. Repeat the application ten days or two weeks later, using bordeaux and lead. Various devices for catching beetles jarred from the vines have been invented, and, while such methods are too tedious and expensive for use over large areas, they may be employed to advantage where only a small patch is infested. A few worms on a poor soil may do greater damage than many worms on a well-fed and well-drained soil; therefore a primary recommendation is to improve the health of the land.

Grape leaf-hopper

This insect is minute, yellowish white, and very active. It passes the winter in brush piles, waste land, grass, and leaves about the vineyard, in the spring flying up to the vines, where it feeds on the underside of the foliage, piercing the leaves and sucking the sap. Grapes having thin leaves suffer more than do the heavier-leaved varieties. Most of the hoppers of the summer brood reach maturity by the first of August.

Lime-sulfur solution destroys the hoppers, but it also burns the foliage severely. Tobacco extracts are most successful, and Black Leaf 40, one half pint to one hundred gallons of water, is recommended for use during the early part of July to kill the young hoppers. Spraying must be done thoroughly with a strong pressure pump, and the application must hit the underside of every leaf. Whale-oil soap, one pound to ten gallons of water, may also be applied early in July and the application repeated a week or ten days later.

SUPPLEMENT TO

The Cornell Reading-Courses

PUBLISHED BY THE

NEW YORK STATE COLLEGE OF AGRICULTURE AT CORNELL UNIVERSITY

Entered as second-class matter at the post office at Ithaca, New York

B. T. GALLOWAY, *Director* A. R. MANN, *General Editor*

COURSE FOR THE FARM, ROYAL GILKEY, Supervisor

VOL. III. No. 72 SEPTEMBER 15, 1914 **FRUIT-GROWING SERIES No. 6**

CULTURE OF THE GRAPE

DISCUSSION PAPER

A supplement called the discussion paper is sent with each Reading-Course lesson, for the purpose of bringing out the main points covered and of calling attention to related agricultural facts, practices, or methods. The College encourages an expression of opinion or a statement of experience by means of the questions asked. Each discussion paper filled out and returned will be read carefully, and a personal reply will be made if agricultural information is desired regarding personal or community problems or the subject studied.

New readers should enroll in one or more of the following series of Reading-Course lessons: THE SOIL, POULTRY, RURAL ENGINEERING, FARM FORESTRY, THE HORSE, DAIRYING, FRUIT-GROWING, FARM CROPS, STOCK-FEEDING, VEGETABLE GARDENING, PLANT-BREEDING, COUNTRY LIFE. The first lesson in each series desired is sent on enrollment, and subsequent lessons are sent, one at a time, on the return of discussion papers. *Therefore, in order to receive the other lessons in this series, readers should sign and return this discussion paper, whether the questions are answered or not.* As an aid to students taking Reading-Courses, study clubs may be formed in various localities. References for advanced reading will be given on request. *The space below on this page is reserved for correspondence concerning Reading-Course work, and also for names and addresses of any persons likely to become interested on receipt of information.*

(*In answering questions, attach additional paper if needed and number the answers.*)

1. What factors are of importance in the selection of a region for the growing of grapes? in the selection of the particular field?

2. How may new plants be obtained from the wood that is removed when the vines are pruned? Would you obtain plants for a commercial vineyard in the manner outlined in answer to the preceding question?

3. How would you proceed to mark out the field and to set the vines?

4. What should be the management of the soil after the vines are set and previous to bearing?

5. What principles govern the grower in the pruning of the grape?

6. Outline the three common methods of pruning and training grapes, beginning with the planting of the vine. Which method is used most in your locality?

7. Under what conditions would you deem the use of commercial fertilizers in the vineyard desirable, and how would you proceed to determine the kind of fertilizer needed?

8. Are cover crops commonly used in vineyards? What qualities should a cover crop possess in order to be adapted to vineyard work? Name some cover crops that meet these requirements.

9. What is the common method of harvesting and marketing grapes? If you desire exceptionally fine fruit for a special trade, how may you secure it?

10. What are the commercial varieties of grapes in New York State in order of importance? What varieties are grown chiefly in your section?

11. Name the most serious insect enemies and diseases of the grape, and outline the methods of their control. Which are most serious in your section?

Name..

Address..

Date..

CIRCULAR No. 1 DECEMBER, 1913

Farm Bureaus of New York State

NEW YORK STATE COLLEGE OF AGRICULTURE, NEW YORK STATE DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY, UNITED STATES DEPARTMENT OF AGRICULTURE, COOPERATING.

Published at Ithaca, New York

FARM BUREAUS: WHAT THEY ARE AND HOW THEY ARE ORGANIZED AND FINANCED IN NEW YORK STATE

LLOYD S. TENNY
State Leader for New York

Frequent requests are received concerning the formation of farm bureaus. This circular is published in order to give briefly the aims of such bureaus and to show what may be expected from the work of a county agent. The present plan of organization and the methods of financing the work are also outlined.

THE FARM BUREAU A LOCAL MOVEMENT

The Farm Bureau differs from other so-called extension agencies in agriculture in that it does not represent, nor is it projected from, the State College of Agriculture, the State Department of Agriculture, the State Experiment Station, or the United States Department of Agriculture. The State Leader of the work has his office with the College of Agriculture at Ithaca, but the county agents have no official connection whatever with any of the state institutions. They are, however, appointed collaborators of the United States Department of Agriculture and thus become employees of the National Government and receive the free use of the mail for their public correspondence. The county agent becomes a resident of the county. His work is largely under the control of a committee of local residents, and it depends almost entirely on the residents of a county whether there shall be a county agent within the county. The State Leader is willing to cooperate to the fullest extent with any county that wishes to organize the work. After the work has begun, he assists the county agent by advice and personal visits. The State Leader, however, makes no effort to establish new bureaus in counties which are not ready for the work or where the farmers do not feel the need of a county agent.

HOW FARM BUREAUS ARE FINANCED

At the present time, the New York State Department of Agriculture through an appropriation made by the Legislature during its session of 1912–1913, has the sum of six hundred dollars available for farm-bureau work in any county. All the eighteen counties now maintaining the work in New York State receive this sum from the State Department of Agriculture. The Commissioner of Agriculture has arranged to have the state money paid in monthly installments of fifty dollars, the sum being sent each month to the treasurer of the farm bureau association.

In the counties where the work has first started, the United States Department of Agriculture contributed toward the support of the county agent. Support from this source is now received by ten counties, generally to the amount of twelve hundred dollars per year in each county. No additional funds, however, will be available from this source until Congress appropriates a larger sum of money for the work.

The additional funds needed to carry on the work in a county must come from local sources. In most counties, a large share of this additional fund has been received from the board of supervisors. Annual sums, varying from six hundred to fifteen hundred dollars or even more, have been voted by the supervisors. The money which is so voted should be made payable to the proper official of the farm bureau association, which officer should be under bond and should make payments from the sum through the voucher system. In the past, especially in the beginning of the work, certain railroads contributed generously to the work. At the present time, nearly all the roads contribute a nominal sum toward the salary of the county agent and furnish also free transportation over the lines of their road running through the county. Certain railroads have also been giving splendid support to the work and have been aiding in obtaining cheaper sources of lime, fertilizers, and other farm supplies. In several counties a large share of the money to support the work has come from voluntary contributions. Farmers, merchants, and bankers have all contributed in order to have the work started. Granges, chambers of commerce, and other similar organizations have also been active in assisting to finance the work in some sections.

The total sum needed to carry on the work of a county agent successfully is comparatively large, and no county should undertake the work without sufficient funds. Twenty-five hundred dollars seems the very least that would be required, and at least that amount should be available annually for a period of not less than two years, since positive results should not be looked for under that time. The sum of four thousand dollars annually would be far more satisfactory; it could be used to obtain a better-trained county agriculturist and would provide more money for necessary expenses. An automobile is almost a necessity, for it has been found to double the effectiveness of the work.

THE ORGANIZATION OF FARM BUREAUS

The county agent who accomplishes much in this work needs to be backed by an active organization. No individual working alone can greatly influence the farming of a community. The strongest feature in a chamber of commerce should not be the secretary of the chamber, but the organization of the chamber itself. An organization backing a farm bureau should be strong enough to accomplish for the farmers what the farmers cannot accomplish for themselves. Unless the people of a county interested in better farming are willing to cooperate and unite in an active association to back the county agent, it is doubtful whether it is worth while to organize a farm bureau in that county.

It is not so important just what kind of organization is effected; the important thing is to get an active organization, with committees to direct the work and to assist the county agent in his work. In most counties there has been formed a membership organization with a nominal membership fee of one dollar. Any one interested in better farming is eligible to membership. Regular officers are elected annually. The executive committee is the most important feature of the organization, for on this committee falls the responsibility of directing the work. This committee should be comparatively small in number and should plan on monthly meetings, at least. In counties where boards of supervisors or similar organizations contribute largely to the support of the work, it is frequently arranged to have representatives from these organizations on the executive committee. It is probably best to have these representatives only nominated by the cooperating bodies and to leave their final election to the members of the county farm bureau association at their annual meeting. A sample constitution and by-laws for a farm bureau association is given at the end of this circular, not with the idea of having every county adopt the exact wording, but merely as an outline for associations to follow in drawing up such a constitution for their particular needs.

THE COUNTY AGRICULTURIST

In New York State the selection of the county agent for any particular county rests primarily with the executive committee of the county organization, although the State Leader reserves the right of approving of their choice. As the work has developed in this State, it has seemed far better to make the responsibility for the success or the failure of the work rest within the county. This would not be possible if local residents were not free to select their own county agent. The State Leader is very willing to confer with the committee in regard to this important matter and will even suggest names of men who will be approved by him, but the final selection rests with the executive committe. In general there are four requirements more or less insisted on by the State Leader for the applicant for county agent: First, he should be a farm-trained boy. Secondly, he should have a broad training along agricultural lines, preferably being a graduate of an agricultural college. Thirdly, after graduation he should have been engaged successfully in some line of agricultural work, preferably in managing actual farm operations. Fourthly, the county agent should have a pleasing personality and should be able to secure the confidence of farmers with whom he is working. Without this, all other qualifications would be of little use in his work.

THE WORK OF THE COUNTY AGRICULTURIST

There are many different ideas of what the county agricultural agent must do. As a matter of fact, county agents now employed in New York State differ widely in their methods of work. We do not know yet just the character of work that will be most effective. It is doubtful whether there will ever be a set plan of work for every county agent. The individuality of the man will probably determine to some extent the character of his work. Certainly it will be true that the character of the agriculture of the county will influence the work greatly. The following are some of the principles which appear to be developing from the work thus far:

1. The county agent is not an office man. His work is with the farmers on their own farms.

2. The county agent is primarily not an institute man or a lecturer. A certain amount of this work is permissible, especially as it often gives a new man a good opportunity to become acquainted with many farmers. Frequently, too, it is possible for him to come in touch with good cooperators at meetings.

3. The work of the county agent is primarily *not* experimental; he is to take the principles which have been worked out at the experiment stations and in other ways and have them adopted by the farmers themselves.

4. In order to reach a majority of the farmers within his territory, it is necessary for him to work with groups. A demonstration plot may be worked out on an individual farm, and this must be used as an example for the farmers in that community. Field meetings can be held from time to time in order to follow the work of this demonstration.

5. Farm surveys must be made and labor incomes must be determined in order to assist the county agent in determining what type of farming is most profitable in his locality. Many county agents can use this means best in carrying on their work, and every county agent should make use of surveys to some extent. Without the farm surveys or some other very definite line of work, the county agent is rather likely to do aimless work, and he will find sooner or later that his entire time is being used up with small, insignificant duties and that the greater agricultural problems of the county are not reached.

THE LOCATION OF THE OFFICE, AND METHODS OF TRANSPORTATION FOR THE COUNTY AGRICULTURIST

While the work of the agriculturist is primarily in the country with the farmers, nevertheless he needs a good office. One day a week should be spent there in answering correspondence and in conferences with farmers and others regarding individual problems. A certain day of the week should be set aside definitely for this office work, and this fact should be so advertised. There is wide diversity in different counties in regard to the number of calls at the office of the county agriculturist. In some counties there are very few or almost none at all; in others, there are comparatively large numbers.

These differences are due largely, no doubt, to the individuality of the county agent, to the differences in the character of the agriculture in different counties, and especially to the location of the office. The office should be very accessible to the farmers, both as to the city or the town, and also in its particular location within the city. A ground floor location is probably the best, and this should be near the trading center or the public market where farmers are most likely to gather. If possible, arrangements should be made to have some one at the office during the entire day. This may mean the sharing of the office with another person, or the employing of a clerk or a stenographer. In many cases it has seemed best to locate the county agent with the chamber of commerce or the board of trade. This location has decided advantages. It greatly facilitates the office work. It provides telephone service that is dependable. Frequently also it is an inspiration and a help to the county agriculturist. The main objection to this location is the difficulty in getting the farmers to come there. These advantages and disadvantages of different locations are given in order to assist executive committees in locating the offices under the very best conditions.

The county is too large a unit for the agriculturist to cover except with an automobile. Some county farm bureaus buy a car outright and maintain it. Others pay for a car on a mileage basis, when a bank or certain individuals have become responsible for the initial cost of the car. In a few cases the county agriculturist owns his own car and the farm bureau pays a certain rental and also maintains the car. The important consideration is to have an automobile for the county agent; by this means the work can be doubled, and those farmers can be helped who are in greatest need and who are receiving the least assistance from other types of agricultural educational work.

THE FREE USE OF THE MAILS

An employee of the National Department of Agriculture is permitted to send his official mail under frank without the addition of postage stamps. The stationery for the use of the county agent can be printed locally, but certain rules must be observed. The official stationery should show the nature of the work being conducted by the agent authorized to use the stationery, should omit all printed names, and should show the cooperative relations existing between the Department and the other agencies. Letterheads showing the names of officers, executive committees, or county agent in print should not be used. The location of the office may be indicated. The following sample is satisfactory for a letterhead:

THE JEFFERSON COUNTY FARM BUREAU
FARM MANAGEMENT FIELD STUDIES
AND DEMONSTRATIONS

New York State College of Agriculture,
New York State Department of Agriculture,
Bureau of Plant Industry,
U. S. Department of Agriculture,
Jefferson County Board of Supervisors, and the
New York Central & Hudson River Railroad,
cooperating

Office with
Chamber of Commerce
4–6 Flower Bldg.
Watertown, New York,

All franked envelopes must be furnished from Washington, as it is unlawful for any individual to print a government frank. It is not proper to print, stamp, or write a local return clause on any envelop furnished. No individual, other than the regularly appointed agent, is permitted to send any matters under government frank, even though it might relate to the official work of the farm bureau. No unsigned circulars are frankable. Letters relating to obtaining membership in a farm bureau association, when there is a membership fee connected therewith, are not frankable. The rules of the Post Office Department are very strict, and unless the county agent is certain that the matter he wishes to mail is frankable, he should refer the matter to the State Leader.

ROSTER OF FARM BUREAUS IN NEW YORK

List of counties in New York State in which farm bureaus are established, with names and addresses of the county agricultural agents (correct to December 1, 1913):

County	Agent	Address
Allegany	F. C. Smith	Wellsville
Broome	E. R. Minns	Chamber of Commerce, Binghamton
Cattaraugus	H. K. Crofoot	Olean
*Chautauqua	H. B. Rogers	Chautauqua
Chemung	G. P. Scoville	Chamber of Commerce, Elmira
Clinton	C. B. Tillson	Plattsburgh
Cortland	E. H. Forristall	Cortland
Dutchess	F. C. Lacy	Poughkeepsie
†Erie	....	
Franklin	O. F. Ross	16 Frederick St., Malone
Herkimer	M. E. Chubbuck	Herkimer
Jefferson	F. E. Robertson	Watertown
Monroe	L. A. Toan	Chamber of Commerce, Rochester
Niagara	E. H. Anderson	Board of Trade, Lockport
Oneida	G. W. Bush	Chamber of Commerce, Utica
Onondaga	S. A. Martin	112 Court House, Syracuse
Oswego	H. M. Doyle	Oswego
St. Lawrence	C. S. Phelps	Canton
Tompkins	H. E. Babcock	Ithaca
Wyoming	W. L. Markham	Perry

CONSTITUTION AND BY-LAWS

CONSTITUTION AND BY-LAWS OF THE .... COUNTY FARM BUREAU ASSOCIATION

Name

The name of this organization shall be the .... County Farm Bureau Association.

Objects

The objects of this association are to develop better agriculture in ....county, New York, and to foster all interests, commercial, social, and material, having a bearing on the development of agriculture.

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*The agricultural agent has not been appointed a collaborator of the United States Department of Agriculture.

†No agricultural agent yet appointed.

Membership

All persons are eligible to membership in this association on payment of the membership fee and subscription to the constitution and by-laws of the association.

Fees and dues

An annual fee of one dollar ($1.00) shall be charged for active membership in this association, but there shall be no restrictions on voluntary subscriptions authorized by the association for special purposes.

Officers

The officers of the association shall consist of a President, Vice-president, Secretary, Treasurer, and a county agricultural agent; all of these except the county agent, shall be elected for a period of one year and shall serve without compensation until their successors are elected. The county agent shall be appointed for such time and be given such compensations as the Executive Committee may determine.

Election of officers

Excepting the county agent, the above named officers and the members of the Executive Committee referred to hereafter, shall be elected for the first time at the first meeting of the association at which permanent organization is effected.

Executive Committee

The Executive Committee shall consist of seven members elected as follows: The President and the Treasurer of the association shall be members ex-officio; two members shall be elected at the annual meeting of the association, one member shall be a district superintendent of schools within the county, who shall be elected at the annual meeting of the association; one member shall be nominated by the Pomona Grange and shall be elected by the association at its annual meeting; one member shall be nominated by the county board of supervisors and elected by the association at its annual meeting. When nominations are not made as indicated above and when nominations by other organizations are required, such nominations shall be made by the association in annual session.

Duties

The President shall perform such duties as usually pertain to the office of the president. He shall have the power to fill such vacancies as may occur in any office or committee. He shall, in conjunction with the Secretary, make requisition on the Treasurer for such sums of money as may be required for disbursement. He may call meetings of the associations or any of the committees whenever he deems it advisable or on the application of any twenty-five members of the association; he shall call special meetings when the demand is made in writing setting forth the objects of such meetings.

The Vice-president shall perform the duties of the President in case of his absence or disability.

The Secretary shall perform such duties as usually pertain to the office of the Secretary.

Upon written requisition from the President and Secretary, the Treasurer shall draw all checks and vouchers for the disbursements of this association and shall have general charge of the funds of the association. The Treasurer shall give bonds to the amount determined by the Executive Committee, the cost of which bonds shall be paid by the association.

The Executive Committee shall outline the general policy of the association, and shall have the power to fix the salary of the county agricultural agent, to make contracts which shall be signed by the President and Secretary, to make cooperative arrangements with the New York State Department of Agriculture, the New York State College of Agriculture, etc., and to transact all the business of the association.

The county agricultural agent shall be under the general supervision of the State Leader of the Farm Bureau work in New York State.

Meetings

The annual meeting of this association shall be held on the first Tuesday of December in the city of ....

The Executive Committee shall hold monthly meetings at such times and places as they may determine.

Committees

The following committees shall be appointed by the President: Finance, Membership, Dairying, Horticulture, and such others as may be deemed advisable by the Executive Committee.

Order of business

The order of business at all meetings of the Executive Committee shall be as follows:

1. Roll call.
2. Reading minutes of previous meetings.
3. Reports of committees and consideration of such reports.
4. The Treasurer's report of receipts and disbursements.
5. Bills and accounts.
6. Reports and recommendation of the county agricultural agent.
7. Suggestions for improving methods of work.
8. General business.
9. Adjournment.

The order of business for the annual meeting of the association shall be the same, with the following additional items and the exception of the roll call:

10. Annual report of officers.
11. Annual election of officers.
12. Adjournment.

Amendments

The constitution and by-laws of this association may be altered or amended by a two thirds vote of the members of the association present at any regular meeting or at a special meeting called on request of twenty-five members, notice in writing of the proposed changes having been given to all members of the association at least one week previous to the time of the meeting.

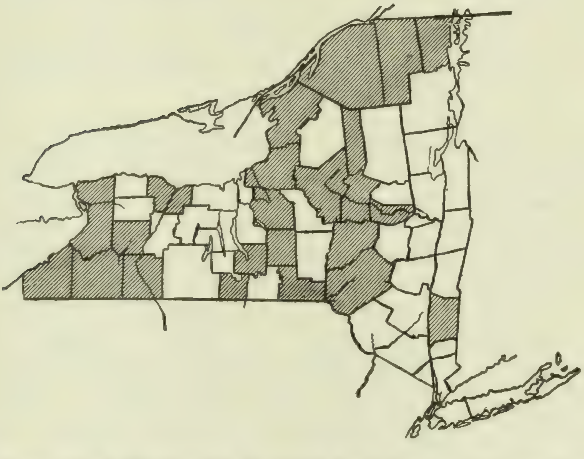
CIRCULAR No. 2 MARCH, 1914

Farm Bureaus of New York State

NEW YORK STATE COLLEGE OF AGRICULTURE, NEW YORK STATE DEPARTMENT OF AGRICULTURE, BUREAU OF PLANT INDUSTRY OF THE UNITED STATES DEPARTMENT OF AGRICULTURE, COOPERATING.

BROOME COUNTY: AN ACCOUNT OF ITS AGRICULTURE AND OF ITS FARM BUREAU

By E. R. MINNS
Farm Bureau Agent of Broome County



The darkened areas show the counties in which farm bureaus had been organized up tc March, 1914

UNDER THE DIRECTION OF
M. C. BURRITT
STATE DIRECTOR OF FARM BUREAUS

ITHACA, NEW YORK
PUBLISHED BY THE UNIVERSITY
[2241]

PREFACE

At the present time there is no complete and specific information concerning the history and present status of agriculture in the various counties of New York State, written in popular language and available to the general public. In the belief that such information is wanted both by the residents of the county itself and by interested persons outside the county, and that the publication of local agricultural facts and conditions in each county will do much to arouse local pride, to call attention to local problems, and to make known the agricultural advantages and opportunities in a county, a series of circulars[1] has been projected.

It is expected that each of these circulars written by the local county farm bureau agent under the general direction of the State Director of Farm Bureaus, will present a fairly complete statement of the agricultural conditions and possibilities of a county. Beside a brief history of agriculture in a county, each circular will include a description of the local climate, soil, and topography, a statement of population, general business conditions, market facilities, types of farming practiced, and tables showing total production and unit yields. It will also point out desirable systems of farm management, suggest changes which should be made, and call attention to many other important matters on which success in farming depends locally.

A second part of each of these circulars will consist of an account of the local farm bureau, its organization, and its ability to help in developing the agriculture of the county. One of the most important functions of a farm bureau association is to study local problems with the purpose of finding out and presenting solutions to them. Such an association should be interested also in presenting to the general public in an attractive manner the opportunities for farming in the county, and in stimulating local initiative. To increase the net incomes of farmers and to help in obtaining better schools, churches, and roads, is to promote the welfare of every citizen in the county. Such cooperative effort, properly directed, should also result in a material increase in land values. All these things the State College of Agriculture and the other parties cooperating in the farm bureau work in New York State desire to promote. This publication, it is thought, will greatly aid the proposed work.

The Broome County Farm Bureau was the first established in New York State; in fact, it was the first organization of its kind in the United States to be known by the name of county farm bureau. It has been in continuous operation since March 20, 1911. Its growth has been slow but steady, and it has now become a permanent local institution. This pioneer county farm bureau has in a measure furnished an example to other counties in the State and in the United States, and many principles and facts with reference to the farm bureau movement have been worked out here. It is therefore eminently fitting that Broome county should form the subject of the first of these county circulars of information.

M. C. BURRITT,
State Director of Farm Bureaus.

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[1] Circular No. 1 dealt with the farm bureau movement in general.

BROOME COUNTY: AN ACCOUNT OF ITS AGRICULTURE AND OF ITS FARM BUREAU[2]

PART I

THE AGRICULTURE OF BROOME COUNTY

Broome county belongs to the southern tier of New York State counties. It contains 705 square miles, 4017 farms embracing 411,475 acres, and is populated by nearly 80,000 persons. It has been settled for about 125 years, but the greater part of the land has been tilled for only 75 years or less. The county, which is shaped somewhat like a shoe with its base to the south, is located on the forty-second parallel, and extends about 35 miles from east to west, 28 miles from north to south on the western side, and 13 miles on its eastern side. The farming is general, with dairying as a leading enterprise. The soil is moderately good, but the topography makes much of it unavailable for the growing of many crops. On the whole the climate is favorable to general types of agriculture. Local markets and transportation are excellent. Good farm land may be had at low prices, and the opportunity for progressive farmers with sufficient capital is promising. A farm bureau has been established in order to aid in the development of these opportunities.

HISTORICAL

The history of agriculture in Broome county previous to the Revolutionary War, is a matter of Indian tradition. Before the famous expedition of General Sullivan, in 1779, the region was a wilderness inhabited by a tribe of the Six Nations. The early settlers testify that the river flats and the neighboring hillsides were partially cleared by the Indians. Grass grew on the flats, and when the corn crop failed breadstuff was pounded from the roots of a tall weed.

The first settlements by white men were made in 1785 by pioneers from New England. In 1787, there came the first white man to make a permanent settlement in the neighborhood of Binghamton, Captain James Leonard, formerly of Plymouth, Massachusetts. Previously to 1787, some persons from Massachusetts had viewed the region and obtained a grant from their own State to purchase a tract of land from the Indians. Sixty persons were admitted to the company. Five commissioners, appointed to treat with the Indians, obtained from them a tract of 230,000 acres at an average cost of one shilling an acre. The members of the company sold their holdings for twenty-five cents to one dollar an acre.

The Indians reserved the right to hunt on these lands for a period of seven years. They also reserved one half mile square near the mouth of Castle Creek where about twenty families resided, cultivating the land more or less, but continuing their hunting and fishing.

Following the Indian trails, roads were soon opened by the early settlers up and down the river valleys. A sleigh road to Unadilla was opened in 1788. In the same year a sawmill, the first in the region, was erected at Glen Castle on Castle Creek. At first the nearest gristmills were at Shepherd's Hills, forty miles down the Susquehanna or Wattles Ferry, seventy miles up the river. In 1790, the first gristmill was built on Fitch's Creek.

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[2] The farm bureau is cooperatively supported by the Broome County Farm Improvement Association, the Broome County Board of Supervisors, the Bureau of Plant Industry of the U. S. Department of Agriculture, the New York State Department of Agriculture, the New York State College of Agriculture, the Binghamton Chamber of Commerce, and the Delaware, Lackawanna and Western Railroad Company.

From the Indians, the settlers obtained seed corn and potatoes. Other seeds were brought from the Hudson Valley. It was soon found that enough grain and vegetables could be grown not only to satisfy their own needs, but to leave a surplus for market. Their cattle multiplied also, and, in the year 1791 or 1792, General Joshua Whitney was sent with a drove of seventeen cattle through the wilderness to Philadelphia. On the return trip he brought mercantile goods part way on Pennsylvania wagons and the remainder of the way on board a Durham boat pushed up the river by six men.

An early writer[3] mentions wheat as one of the staple crops grown by the pioneer farmers. In describing the region around Binghamton, the county seat, he says, " Rich and expansive meadows lie upon the banks of the Chenango, with extensive cultivated fields. . . .. Likewise upon the banks of the Susquehanna, are extensive grazing and arable fields. The soil of this great plat is truly rich and fertile, generally under a high state of cultivation; and the great quantities of plaster now brought into the place for grinding and sale, will render it feasible as well as place the motive before them for farmers and proprietors to render their lands as productive as even the cupidity of man could wish."

Broome county was set off from Tioga in 1806 and named for Lieutenant Governor John Broome, a New York City merchant. Binghamton received its name from William Bingham, the proprietor of a large patent of land lying on both sides of the Susquehanna. He authorized the first survey of the village in 1800, sold the surveyed lots at reasonable prices and on easy terms, and when the county seat was located there, "he conveyed to the county gratuitously a spacious lot for the Court House, also a lot for a public school."[3]

Lumbering was an important industry around Binghamton and along the Chenango and Susquehanna rivers during the early decades of the last century. White pine and white oak of fine quality were found in the tributary valleys. Mention is made of the large quantities of locust timber taken from the town of Windsor. The facts that good timber occupied the best lands adjacent to the river valleys, that it was necessary to remove these trees before farming could begin, and that, during the spring freshet, timber floated down the Susquehanna on rafts found a ready market, made lumbering more attractive than farming for many of the pioneers. But when the pine began to fail, the settlers began to cultivate the soil and the substantial improvement of Broome county commenced. Public recognition of the importance of agriculture was afforded in the first annual fair and cattle show of the Broome County Agricultural Society, which occurred in October, 1842.

Transportation facilities for heavy and bulky articles were much increased with the completion of the Chenango Canal, which connected with the Erie Canal at Utica and thus made possible direct communication between the east and the west. In 1841, the first section of the Erie

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[3] J. B. Wilkinson, " Annals of Binghamton." 1840.

Railroad from Piermont to Goshen was opened for traffic. On December 28, 1848, the section from Port Jervis to Binghamton was finished, giving rail transportation from the seat of Broome county to the seaboard. Railroad building continued until Broome county was connected by rail with Syracuse, Utica, Albany, and Buffalo in this State, and with the rich coal fields of Pennsylvania.

PRESENT AGRICULTURAL CONDITIONS

The climate of Broome county is similar to that of other inland regions in the Appalachian Highlands, moderate in temperature, ample in rainfall, and with a fairly long growing season. The hills and valleys sometimes produce wide local variations in temperature and precipitation. Since 1890, the United States Weather Bureau has had a local station at Binghamton, the junction of the two principal river valleys. The records of the station extend over a period of thirty-three years.

These records show the mean annual precipitation to be 32.94 inches. The lowest precipitation for any year was 22.42 inches, this occurring in 1900. The highest record was 39.93 inches in the year 1893. The mean annual rainfall during the growing season from May 1 to October 1 is 16.34 inches. Severe summer droughts are occasionally felt, as in 1913 when the total rainfall for June, July, and August was 3.79 inches. Ordinarily the summer rainfall is abundant for agricultural needs. It was excessive in August of 1912, when 7.72 inches of rain fell during the month.

The mean annual temperature at Binghamton is 46.6° F. Of more importance is the length of the growing season, which for twenty-one years has averaged 154 days. The average date of the last killing spring frost is May 16, and of the first killing autumn frost October 17. The variations in length of growing seasons and in the summer rainfall are elements of uncertainty that to some extent limit the range of profitable crop-growing.

The topography of Broome county is that of a plateau region through which the streams have cut deep valleys. The valleys of the Susquehanna, Chenango, and Tioughnioga rivers with their tributary streams, each separated by hills that rise from four to ten hundred feet above the river channels, form the chief topographical features of the region. The Susquehanna River crosses the county twice through a valley one half to two miles wide. Along the rivers are fertile flats subject to overflow, extensive stream terraces form the most valuable lands of the region.

The underlying rocks of Broome county consist of sandstones and shales of the Chemung and Catskill groups. Erosion and glaciation have have given the soils a complex origin especially in the valleys where irregular areas of loam soils, mainly of the Dunkirk series, are found. Over the hills is spread a mantel of soils, which are derived mainly from the disintegration of the underlying rocks, and which belong almost entirely to the Volusia series. Good springs abound on the hillsides, frequently causing wet areas where the tenacious subsoil, or "hardpan," prevents the water from draining downward. In certain limited areas the shaly character of the soil makes it so porous and friable that it is well suited to potato-growing. The hill soils have good surface drainage, but many farms need underdrains to remove the surplus water from the subsoil.

The Thirteenth Census records a population of 78,809 for Broome county. This is an increase of 9660 for the decade preceding. The development of manufacturing and transportation in the Susquehanna Valley was the cause of this increase. Rural population had declined to some extent, and the persons engaged in farming numbered 4017. During the decade 1900–1910 there was a shrinkage of 393 in the total number of farms owing to the inevitable and desirable consolidation of certain small farms and to the absorption of others by the growth of the manufacturing industries.

The New York State Industrial Directory for 1912 reports a total of 267 factories in Broome county, of which 208 are in Binghamton, the county seat. The employees in all factories number 13,594, of which 8823 are workmen. In the order of their importance, the principal manufactures are: cigars, shoes, furniture, leather, scales, valves, wagon and carriage hardware, photo supplies, and time-recorders. There has been a marked expansion in business during recent years, which is reflected in the rapid growth of Binghamton, Lestershire, and Endicott. The manufacturing industries in the county are generally prosperous, and their employees are steady customers for farm products. As a local market, Binghamton is among the best in New York State.

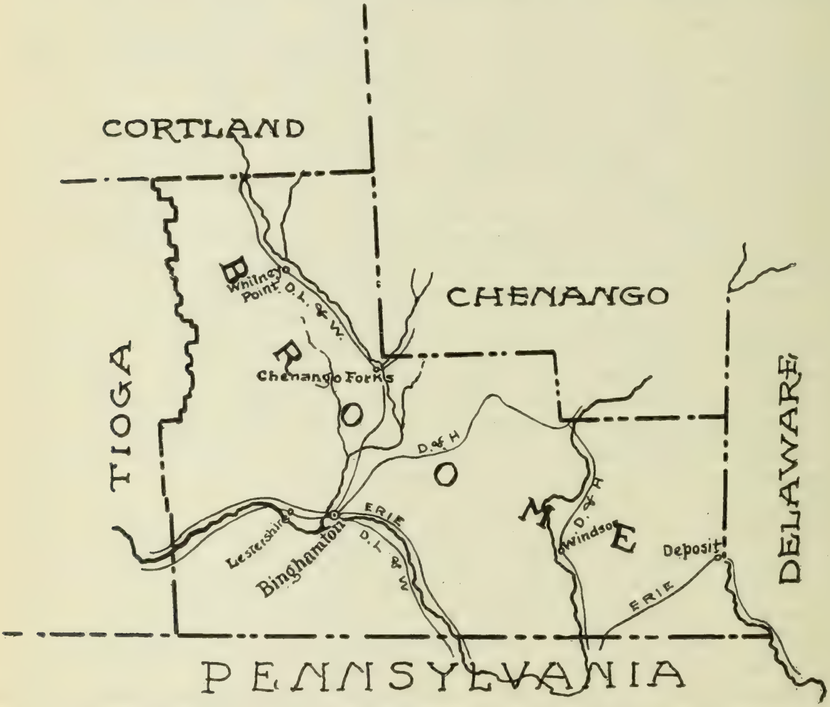


Fig. 1. — *Map of Broome county, showing transportation systems and principal towns*

The transportation facilities of Broome county are unexcelled. Two great transportation systems, the Erie, and the Delaware, Lackawanna and Western, connecting New York City and the West, run through the county. The latter also gives excellent service to northern points in the State by way of Syracuse and Utica. Still another line, the Delaware and Hudson, provides a ready means of trade with New England by way of Albany. The system of highways in the county includes 117.6 miles of state macadam and brick roads and 1319 miles of well-drained and fairly well-maintained dirt highways.

TYPES OF FARMING ROTATIONS AND CROPS

The types of farming followed in the county may be classed as general, dairy, and trucking for the local markets. Most of the hill farmers keep live-stock, including dairy cattle, and derive their incomes chiefly from this source, but also from the sale of potatoes, hay, and buckwheat, and occasionally from fruits. On a considerable number of farms the receipts from wholesale milk are the main sources of cash income. Beside the milk consumed in the city and villages, considerable quantities are sent out over the three railroad systems, chiefly to New York City. The output of cheese and butter from factories is small as compared with that of wholesale milk. A comparatively large amount of certified milk is produced, both for the local and for the New York trade.

In the river valleys truck farming is practiced on some of the best soils. The annual production of vegetables and fruits is not sufficient to supply the local needs all the year. Most of the truck farmers are prosperous, and some of the general farmers add one or more truck crops to their sources of income with profit. As a source of cash income poultry is important on many of the general farms. A few farmers make chickens their main source of income. Swine are few in number and usually are kept as a market for unsalable products and for a supply of meat for the farm family. Sheep are more numerous than swine although they are not found on as many farms.

TABLE 1. NUMBER AND VALUE OF DOMESTIC ANIMALS IN 1909

	Horses	Cattle	Sheep	Swine	Poultry
Number of each	8,672	45,620	9,600	7,615	184,377
Value per head	$125.43	$32.24	$5.31	$8.92	$.69

In 1910 the number of farms not reporting domestic animals was 330. More than 81 per cent of the farms were buying feed for animals at an average cash outlay of $216.40 for each farm. In 1909, 40 per cent of the farmers bought fertilizers at an average cash outlay of $33.06 a farm. Within the last three years there has been a large increase in the purchase of lime for use on the lands of the county.

TABLE 2. ACREAGE AND YIELD OF PRINCIPAL FARM CROPS IN 1909

Crop	Acres	Total yield	Yield per acre	Average for New York State
		(tons)	*(tons)*	*(tons)*
Hay and forage	108,135	113,789	1.05	1.40
Timothy and clover mixed	59,131	47,609	.80	1.09
Timothy alone	24,815	20,604	.82	1.07
Clover alone	204	287	1.40	1.30
		(bushels)	*(bushels)*	*(bushels)*
Corn	2,740	85,215	31.0	35.4
Oats	12,950	287,170	21.4	26.7
Wheat	211	4,497	21.3	23.0
Barley	57	1,842	32.4	24.0
Rye	745	12,244	16.3	15.4
Buckwheat	7,894	154,982	19.6	19.9
Beans	10	233	23.3	14.0
Potatoes	7,106	708,144	99.6	123.2

The crop rotations most practiced in the county are somewhat as follows:

1. Corn or potatoes on soils adapted to them. (As an alternative buckwheat or millet may be used.)
2. Oats with which clover and timothy seeds are sown. (When rye is used, it follows oats or occasionally potatoes.)
3. Hay for an indefinite term of years. Lack of lime and in some cases of humus, has made clover production so uncertain that the crop is seldom grown alone.

The value of all farm property in the county increased 9.8 per cent in the last decade, while the value of farm land alone decreased $1.61 an acre. This would indicate that the higher value of all farm property is due to the increase of live-stock and better buildings and equipment.

The size of farms varies considerably, but large farms are few in number. The last census reported for the county as follows: 26.5 per cent of farms under 50 acres; 29.5 per cent of farms of 50 to 99 acres; 28.6 per cent of farms of 100 to 174 acres. The remaining farms were over 174 acres. The average size of farms is 102.4 acres.

Farm tenancy is not a serious problem in the county for 82.2 per cent of the farms were operated by their owners in 1909. Many of the farms have been in the same family for several generations, but a considerable number have passed into the hands of new owners from eastern cities and from western States. The low price of land has caused many western farmers to consider buying farms in this region of good markets and the best of rail transportation facilities.

AGRICULTURAL OPPORTUNITIES

Many good farming opportunities are to be found in Broome county. Some of the most attractive of these are the following:

1. *Low-priced land for general farming.*— Enterprise and sufficient working capital are needed to improve much of this land. With proper crop adaptation, with good farm organization and wise management,

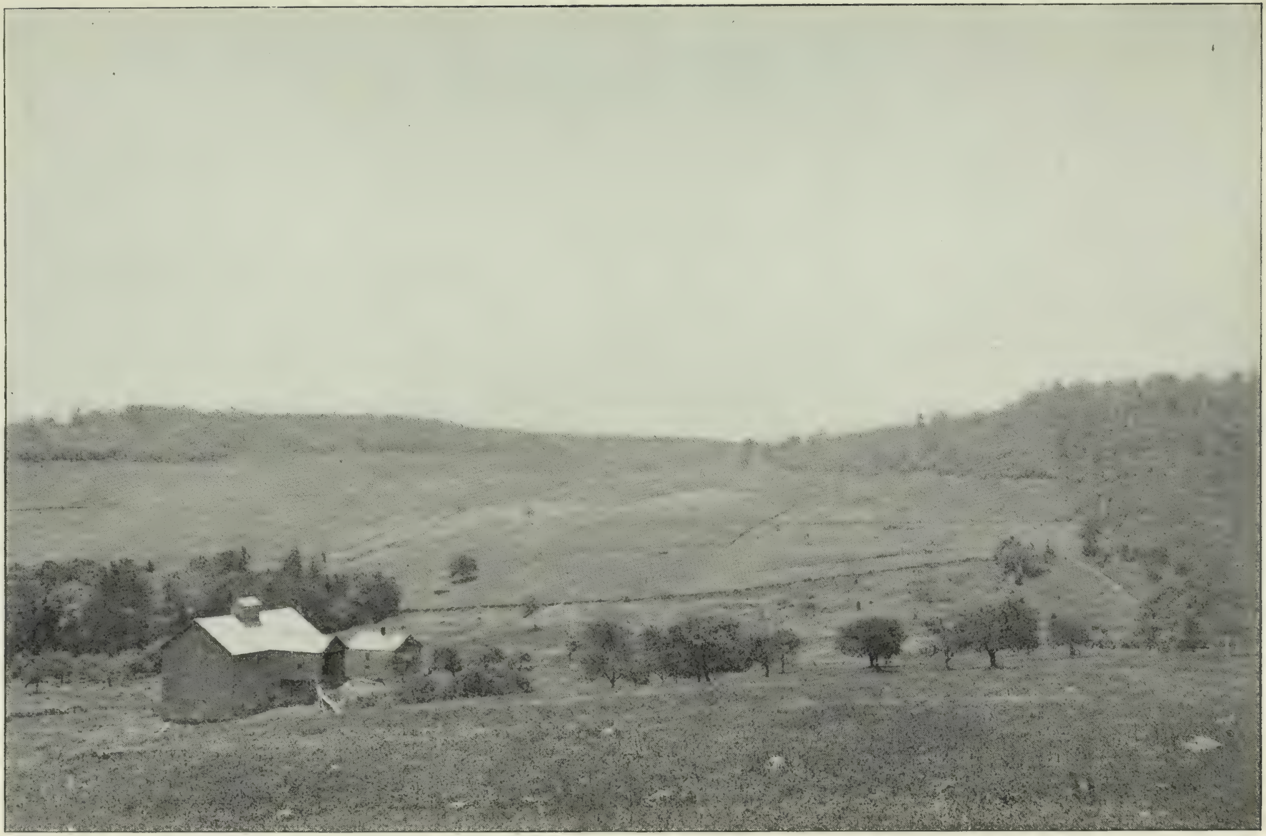


FIG. 2.— *A typical view on the uplands of Broome county. Note the gently rolling and comparatively level fields. The farm in the foreground is producing profitable crops, while the adjoining farm is neglected*

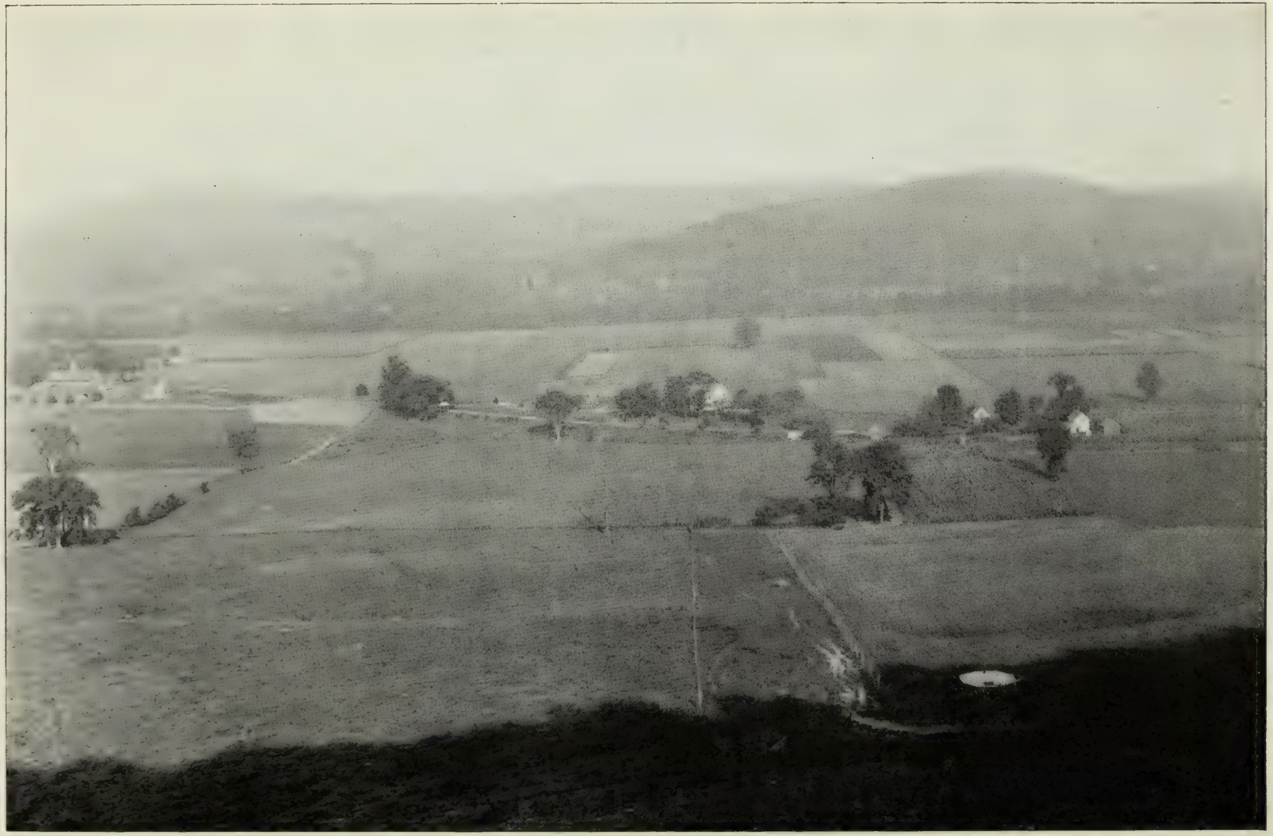


FIG. 3.— *A typical valley scene in Broome county. A general view of a successful farm near Binghamton, New York, showing the level valley with the hill lands in the background*

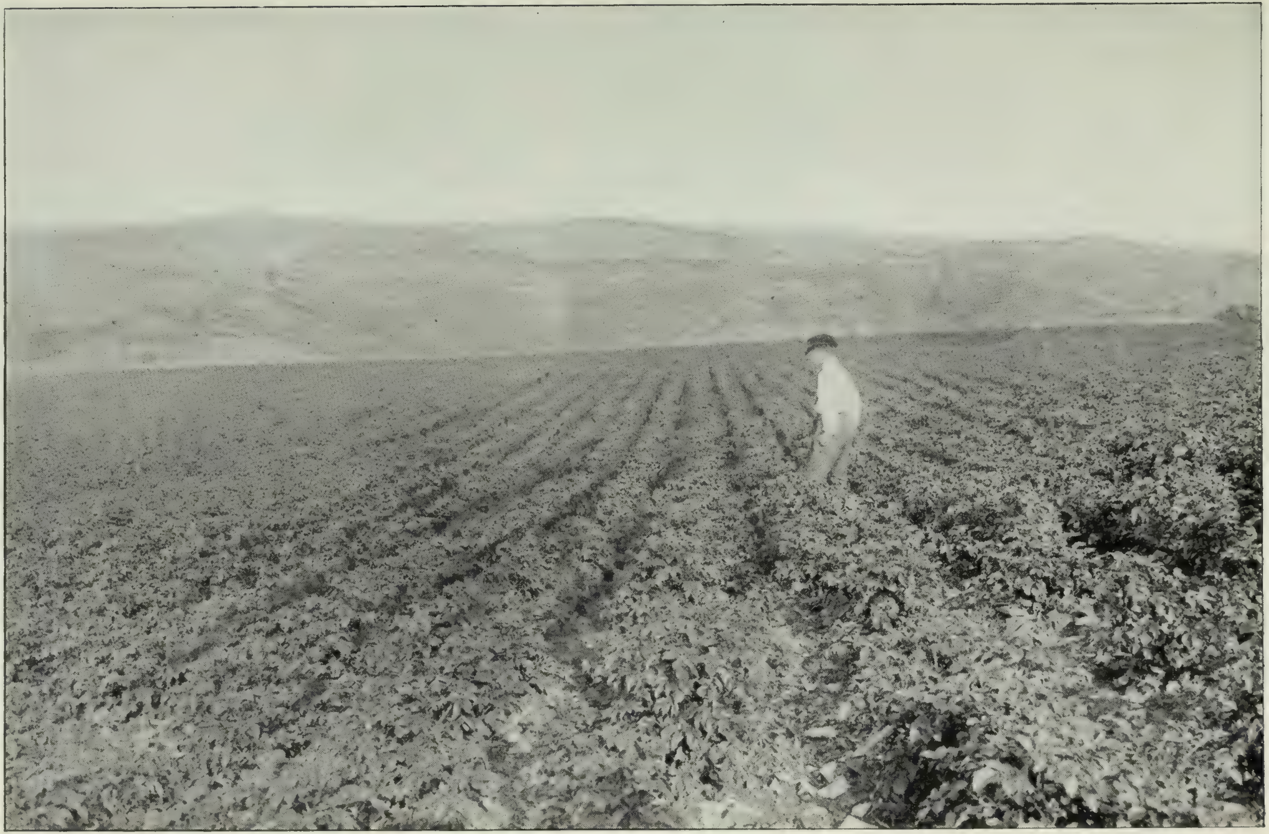


FIG. 4.—*When properly drained much of the hill land is well adapted to potatoes. A view of a potato field near Binghamton, showing a fine stand of potatoes on land that had not been considered worth cultivating for many years previous*

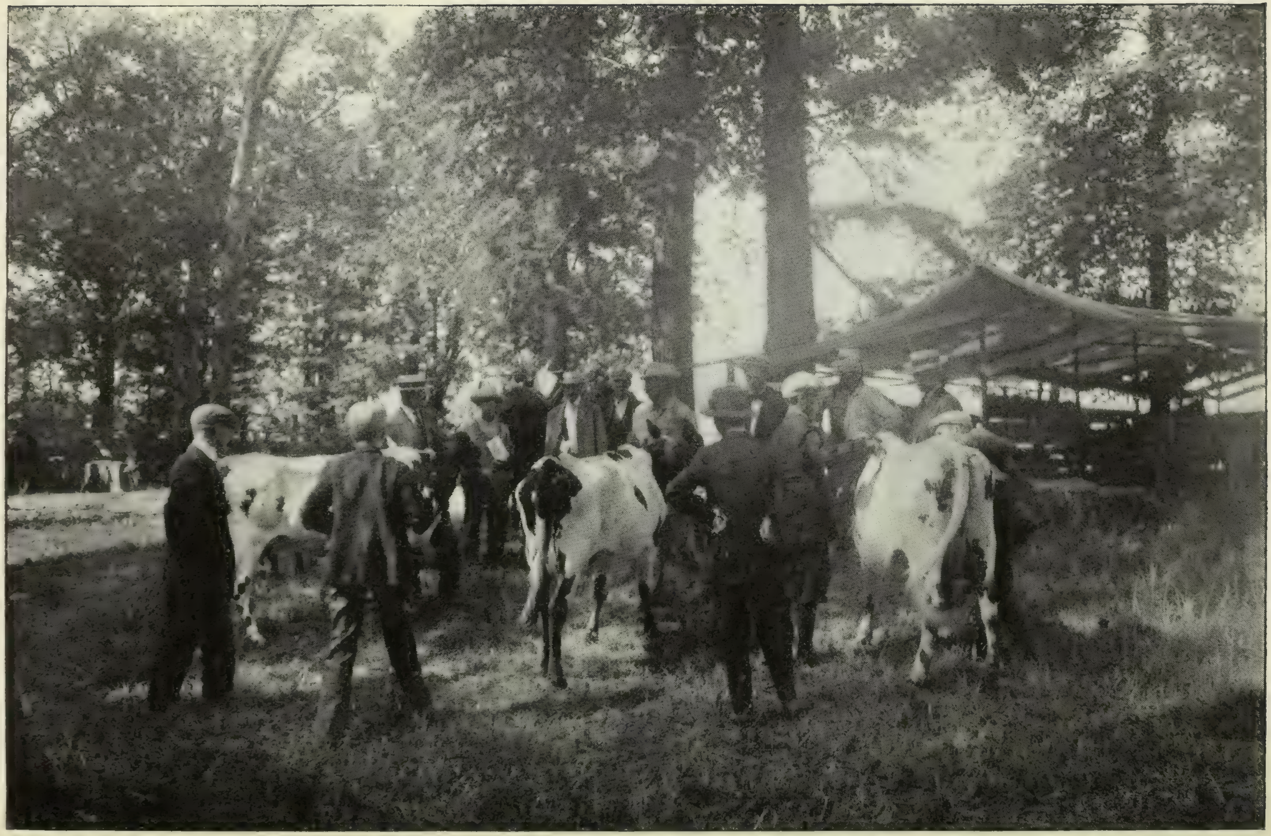


FIG. 5.—*Boys judging cows at the Broome County Fair. Prizes for the contest were obtained through the efforts of the farm bureau This is one of the many activities of the Broome County Farm Bureau*

farm investments pay reasonable profits. By hard work and skillful farming, farms have been paid for in a few years out of the income from the farm. Land values are practically certain to increase.

2. *Utilization of local markets.*— There is a local demand for those perishable products that cannot be cheaply transported from more distant regions. This demand offers an opportunity, which as yet has not been fully utilized. Individual marketing of farm products is widespread around Binghamton, the industrial center of the county. Cooperative marketing is yet undeveloped, but will in time furnish the best opportunity for farmers in the more distant parts of the county to enter the local trade in perishable products.

3. *Development of foreign markets.*— There is excellent rail transportation to such large markets as Scranton, Philadelphia, and New York, where first-class farm products are always in demand. Milk goes by train loads to New York from this region. Eggs and poultry are profitably sold in the metropolis. Surplus hay and potato crops grown in this county can be marketed cheaply.

4. *Excellent business facilities.*— The necessary machinery for buying farm supplies, such as seeds, fertilizers, feed, implements, and household necessities, is well developed. Cooperative buying of supplies is practiced in some of the granges. Greater cooperation in the buying of lime, fertilizers, and feed could be profitably done by clubs or groups of farmers, who wish to economize in expenses without retarding farm development. The county farm bureau, described in the second part of this circular, offers its services to assist in this work.

5. *Opportunities for home-building.*— Broome county is a good place in which to live. The means of communication by mail, telephone, and state highways are excellent and are certain to improve with the increasing material prosperity of the county. These facilitate economic organization and aid social life in the county where good neighborhood spirit is aroused.

SUGGESTIONS FOR THE IMPROVEMENT OF BROOME COUNTY FARMING

For the good of farming in the county some gradual changes in the type of farming should be effected. On many dairy farms there is a pressing need for better cows, and for the elimination of those that are now unprofitable. Dependence on the monthly milk check as the sole source of income is usually not so profitable as the combined sale of milk and that of cash crops. The introduction of improved and pure-bred live-stock to be multiplied for sale on a sufficient number of farms in any community not only will tend to increase the average net return on each cow, but will make farmers less dependent on the wholesale milk market for their incomes.

Many farms are so overstocked with cattle that pastures are seriously injured during the summer. Cattle are also turned out on pasture too early in spring. Where for other reasons it is inadvisable to reduce the stock, pastures should be rotated. Sheep-raising for mutton production seems to offer a desirable type of husbandry for hill lands that do not produce good pasturage for heavy cattle. Judicious pasturing with sheep is said to improve some kinds of pasture land. Inclosure with woven wire fences will be found the best insurance against damage by dogs.

On many farms, especially the smaller farms, poultry might well become a strong supplementary source of income. For the man who wishes to be employed all the year round in productive work, and who finds the hiring of steady labor a serious problem, a one-man poultry farm furnishes sufficient scope for study and regular employment that will probably pay as good wages as any other one-man enterprise in farming. On such a farm some fruit may well be grown also. Small farms, suitable for poultry and reasonably near shipping points, may be had for a very moderate price in Broome county.

Truck farming is mainly confined to the river valleys at the present time. There are small areas of swamp soil and some tracts of land suitable for truck if better drained, which may be developed for vegetable-growing with an additional investment in drainage and fertilizer treatment. It is only a question of time until these tracts will be utilized to produce a larger share of the fresh vegetables consumed by the city and village population.

Fruit farming as a type has never been well developed in the county, probably because of climatic conditions. It is certain that many soils in the county are capable of growing fine berries, pears, and apples. Berries interfere with the summer work of the good-sized general farm, but may well be grown on the small hill farm as an additional source of income. On the general farm, apple orcharding frequently offers a good opportunity to increase the farm income. Under present conditions the renovation of neglected orchards of good varieties of apples, by spraying and good cultural methods, seems bound to be profitable as an additional source of income on the general farm. New orchards should be planted only on carefully selected sites, and always as a part of a farm enterprise which is so well planned that the proper care of the young orchard will not be a financial burden.

Local farm management as a subject for study has not received adequate attention. More and better records of the farm business transactions are needed before much specific advice on farm management can be formulated. Farm bookkeeping is much neglected. Farm-planning is usually indefinite. Much needs to be done in establishing the habit of keeping elementary records, laying out fields so as to economize labor, adapting crops to variations in soils, and in formulating and carrying out systematic rotations of crops for individual farms. Except for those farms in the outlying towns, marketing facilities may be said to be fairly satisfactory. Economy in production demands attention fully as much as does adequate marketing.

Farm practice in the matter of crop culture and the care of live-stock is improving under the influence of individual effort, farm literature, farmers' institutes, the farm bureau, and the educational work of public and corporate milk inspection. The need of conserving stable manure is generally admitted, but the use of phosphatic fertilizers with which to reinforce it ought to be much increased. Fertilizer practice is not generally well adapted to the local needs. While considerable amounts of fertilizer are used in the county, much more could be profitably used where rational practice in liming the land is adopted and the supply of soil humus is adequately maintained. More reliance should be placed on the wise use of green-manure crops and fertilizers to produce cash crops in general farming. Less reliance should be placed on ready-mixed brands of fertilizers, and more fertilizer materials should be compounded or applied as needed on the farm.

It is very desirable that the use of lime should be increased on practically every farm in the county. Especially on the hill lands lime has become a limiting factor to successful crop production. It is next to impossible to obtain satisfactory crops of clover and timothy without the use of lime. As a general rule, the application of not less than 1000 pounds of good fresh burned lime or its equivalent of about 1800 pounds of ground limestone once in a four-year rotation, preferably preceding the grass and clover seeding, will be found profitable.

On too many farms in the county the total amount of business done is too small to provide a satisfactory labor income to the farmers. It is, therefore, desirable to increase the total amount of business done if possible. This may be accomplished in several ways. Two important ways are the following: by increasing the intensity of operation (if the nature of the crops grown makes this profitable), and by increasing the size of the farm either by buying or by renting additional land. Many valley farmers find it profitable to own farms on nearby hills in conjunction with the home farm, as a source of summer pasturage especially for young stock, and to grow supplementary cash crops, such as potatoes and buckwheat.

PART II

THE BROOME COUNTY FARM BUREAU

The Broome County Farm Bureau is unique among agricultural institutions. It was the first farm bureau in the United States to be organized as such. Its organization was effected through the cooperation of the United States Department of Agriculture, the Delaware, Lackawanna and Western Railroad Company, the Binghamton Chamber of Commerce and the New York State College of Agriculture. It has had an agent in charge of its activities almost continuously since March 20, 1911, for the sole purpose of promoting the agricultural prosperity of the region, and particularly of Broome county.

For a number of years prior to the organization of the farm bureau, Binghamton had a chamber of commerce devoted to making Binghamton a larger and a more prosperous city. With the appearance of the report of President Roosevelt's Country Life Commission and the discussion which naturally followed, some members of the Binghamton Chamber of Commerce interested themselves in the problems of the country surrounding Binghamton.

While making some studies of surrounding counties, Byres H. Gitchell, then secretary of the chamber of commerce, made what was at first a disturbing discovery. He found that there were a large number of farms for sale at low prices in the vicinity of Binghamton and a decreasing rural population. The interdependence of city prosperity and country prosperity was recognized, and the local situation was squarely faced by this commercial organization.

The first action taken by the Binghamton Chamber of Commerce was the appointment of a committee to investigate farming conditions and to report on what action should be taken in order to develop farming opportunities. This committee consisted of three successful farmers from the adjacent community, one wholesale grocer, and a certified milk-producer. Representatives of the United States Department of Agriculture and of the New York State College of Agriculture were invited to join the committee on an observation tour of the county.

The conditions found by the committee were interpreted from two opposite points of view. Although there were some farmers without faith in their county's agricultural possibilities, there were many others who felt that study, well-directed labor, capital, and confidence would restore productivity to the low-priced farm lands. The committee concluded that it would be necessary to analyze the local agricultural conditions and then demonstrate local opportunities for improvement by concrete examples of success. Farm management rather than population was seen to be the main question involved.

The chamber of commerce learned that the Delaware, Lackawanna and Western Railroad was proposing to establish a demonstration farm at some point along its lines, and sought the cooperation of the railroad company. The New York State College of Agriculture was enlisted in the project, and went so far as to select the farm and propose a scheme for handling it. On the advice of Professor W. J. Spillman, of the United States Department of Agriculture, this project was abandoned for something better. The work of existing agricultural institutions was considered, and the conclusion was reached that whatever work was undertaken must be local, concentrated, and continuous. In order to obtain the cooperation of all agencies in the field, a joint agreement was entered into between the United States Department of Agriculture, the New York State College of Agriculture, the Lackawanna Railroad, and the Binghamton Chamber of Commerce, to establish a farm bureau. Educational assistance was promised by the College of Agriculture, while the financing of the bureau devolved on the other parties to the agreement. The State Department of Agriculture gave assistance by sending lecturers to help the agent, and he in turn took part in the regular Farmers' Institutes.

John H. Barron was employed as county agricultural agent by the bureau and began work on March 20, 1911. The object of the work as stated in the joint agreement establishing the bureau was as follows.

"The object shall be to undertake propaganda work in the agricultural district in the vicinity of Binghamton, New York, to make an agricultural survey of the territory, to study the farmer's problems, to find their solution by a study of the practice of successful farmers, to study the relation of types of farming to local conditions of soil, climate, and markets, to demonstrate the systems of management used by the successful farmers of the district, to conduct demonstrations with farmers, to carry on educational work through the media of institutes, to advise with farmers individually or otherwise as to the best methods, crops, cropping systems, stock, labor, tools, and other equipment."

After nearly two years of good work, Mr. Barron resigned his position on January 1, 1913. During his term as county agent, the bureau was conducted as a clearing house for the agricultural progress of the region. Many farmers' meetings were held in various parts of the county. Farmers were visited and given assistance on practical matters. Some studies of successful farming were made. As a result of a successful campaign for lower freight rates on lime, the use of that commodity for ameliorating soil conditions was stimulated. In order to save time and to increase the efficiency of the county agent, an automobile was purchased jointly by the chamber of commerce and the Lackawanna Railroad, for his exclusive use.

Early in 1912 the State Legislature made it possible for county boards of supervisors to appropriate money for the development of agriculture within the county. The Board of Supervisors of Broome county then made an appropriation for the farm bureau work which became available on August 1, 1912. On July 1, 1913, an appropriation of $600 from the State (Chapter 712, Laws of 1913) also became available to Broome county. The cooperating parties made a new agreement beginning July 1, 1912, which confined the work to the county limits. As a result of this action, the institution became known as the "Broome County Farm Bureau."

A new chapter in local farm bureau history began when on March 1, 1913, E. R. Minns assumed the duties of agent. On the same date Lloyd S. Tenny took up the work of the first State Leader under joint appointment from the United States Department of Agriculture and the State College of Agriculture, to supervise the organization and work of the now rapidly increasing number of farm bureaus in the State. From his headquarters at the New York State College of Agriculture, the State Leader stimulated and correlated the work of all the bureaus organized.

The new agent began a program of becoming acquainted with the people he would serve by means of a circular letter, newspaper articles, calls at farms, and appearances at meetings. The cooperation of granges and public schools was successfully sought. Farmers were enlisted as cooperators in various parts of the county. The agent collected information of a geographical, social, and economic character. Records of farm management and of the kind and size of farming enterprises practiced in the county were made. Exhibits at two agricultural fairs were useful means of extending the effective work of the bureau.

As the work progressed and bureaus were organized in other counties, the conviction grew in the minds of the State Leader and of the local agent that in order to make the work of this bureau most efficient and successful, there must be behind it the organized sentiment of the farmers for whose assistance it was formed. The farm bureau work seemed to lack the force that the active support of farmers could bring to the organization. Without the farm owners and operators enlisted to give the farm bureau active support, the work must always lack spirit and solid achievement.

Accordingly in cooperation with the State Leader, a meeting of farmers from all parts of the county was called, and an interesting and instructive program calculated to arouse enthusiasm was given. At this time an organization for the purpose of assisting the farm bureau to realize more fully its ideals and purposes, was formed. This was on October 10, 1913. A constitution and by-laws were adopted, officers were elected, and the membership roll was opened with sufficient applications for admission to insure the success of the organization. It was named the Farm Improvement Association of Broome County. Its declared purposes, as set forth in the constitution, are as follows:

1. To foster cooperation in the buying and selling operations necessary to farming.
2. To assist in the operation and promote the usefulness of the Broome County Farm Bureau.
3. To publish for circulation in the county information about the most useful agricultural practices.
4. To promote the interests of the breeders of improved live-stock, and the more profitable production of milk from dairy herds.
5. To promote agricultural contests held under competent supervision throughout the county.
6. To hold meetings for the commercial, educational, and social benefit of all persons in the county interested in farming.

A president, vice-president, secretary and treasurer, and one executive committee member constitute the executive officers of the association. The president is empowered to represent the association in any joint agreement entered into by the association respecting the farm bureau.

Subcommittees charged with promoting the purchase and use of lime and fertilizers, the interests of breeders of pure-bred live-stock, the keeping of production records in dairy herds, and the conduct of agricultural contests, are appointed by the president with the approval of the vice-president and the secretary.

An annual meeting in November and an annual picnic are provided for.

Membership in the association may be had by filing a signed application with the secretary and paying to the treasurer an annual membership fee of not less than one dollar ($1).

The membership of the association has grown slowly and steadily until it now numbers eighty. Eventually it should include every farmer in the county.

LOCAL RESULTS FROM FARM BUREAU WORK

On January 1, 1914, a report of progress made by the agent of the farm bureau included the following results:

In ten months, 310 farmers had been personally visited on their farms. Eighty of these had requested the agent to visit them. In his office the agent had answered 125 calls from farmers and persons directly interested in farming.

Fifteen farmers' gatherings and ten other meetings had been addressed by the agent.

Agricultural-contest work with a total of 123 pupils was carried on in eight public schools. A boys' stock-judging contest was conducted at one of the local fairs, seven boys taking part. Fourteen medals were awarded to prize-winners in the schools, while eight agricultural books and a pure-bred bull calf were awarded as prizes to the boys taking part in the stock-judging contest.

Personal letters of information to farmers numbered 100, and agricultural articles published in the newspapers numbered 24.

A traveling library of 25 volumes was circulated among 80 readers, and 250 farm record books were distributed among farmers.

A farm survey of two communities in the county has been made by the agent in which records of the farm business were taken. In all 37 records have been made, and the farm labor incomes have been computed for the benefit of individual farmers and communities.

Since the above progress report was made, a local bulletin entitled " Liming the Land " has been published and circulated. It illustrates the benefits derived from using lime on Broome county farms, and may be obtained free on application to the agent of the bureau.

A few farmers cooperated with the farm bureau by raising special crops during 1913. It is expected that there will be 25 or more demonstration plats at various places in the county during the coming year. Pasture renovation, orchard renovation, fertilizing meadows, fertilizing and selecting potatoes, establishing clover, alfalfa, vetch, and soy beans in new locations, the keeping of individual milk records, and complete farm accounts are the most available subjects.

Agricultural-contest work in schools, at fairs, and elsewhere will be encouraged with the aid of the Broome County Farm Improvement Association.

Improvement in the live-stock of the county should be stimulated through the formation of breeders' clubs to facilitate the sale and purchase of animals and the cooperation of the breeders in bringing in better sires for their dairy herds. The farm bureau agent will keep a sales list of live-stock for the benefit of all stock-breeders and will use every means to stimulate their interest in community effort at live-stock improvement.

Cooperative selling of some kinds of farm products are needed in the more remote parts of the county. The farm bureau agent is ready to help in the formation of clubs of farmers for buying supplies, for selling produce, and for assisting one another in social and educational ways.

Experience thus far has taught that farm bureau work in Broome county must be continuous, personal, and patient in order to achieve success. It is with confidence in the ultimate justification and substantial success of the movement that friends of the Broome County Farm Bureau are looking into the future.

TEN WAYS IN WHICH A COUNTY FARM BUREAU CAN HELP YOU

1. By furnishing you with the best information available about the growing and selling of your crops.

2. By conducting experiments and demonstrations in your locality so as to find out and make evident beyond a doubt the best farm practices.

3. By bringing your most difficult problems to the attention of experts, and by bringing experts to your farm or locality.

4. By assisting you to analyze your business by the survey and accounting methods so as to find the weaknesses and the strong points.

5. By suggesting changes in your farm management and practice based on the collective experience of your neighbors.

6. By obtaining cheaper supplies, such as lime, fertilizers, and seeds, by promoting cooperative buying organizations, and by disseminating information about prices and quality.

7. By obtaining better prices for your products, by promoting farmers' cooperative selling organizations, and by disseminating information as to crop yields and prices, packing, and marketing.

8. By answering your specific questions, and by giving advice when asked or by obtaining this service for you from others.

9. By promoting efficient farm and community organization, as well as by increasing the local efficiency of all agricultural institutions.

10. By helping your neighbors in all these ways; by making known the agricultural advantages of your county, thereby tending to increase land values and local facilities.

BULLETINS FOR REFERENCE

Note: Those desiring further information about the agriculture of this region, its possibilities, and the best types of farming and farm management, should consult the Broome County Farm Bureau Agent, Binghamton, New York, and read the following bulletins:

United States Department of Agriculture, Bureau Plant Industry, Circular 64. Agricultural conditions in southern New York.

United States Department of Agriculture, Bulletin 32. An example of successful farm management in southern New York.

Cornell University Agricultural Experiment Station, Bulletin 295. An agricultural survey of four townships in Tompkins County, New York.

Cornell University Agricultural Experiment Station, Circular 17. The formation of cow-testing associations.

Broome County Farm Bureau. Binghamton, New York, Bulletin 1. Liming the land; good results in Broome County.

New York State Department of Agriculture, Bulletin 55. Farms for sale or rent in New York.

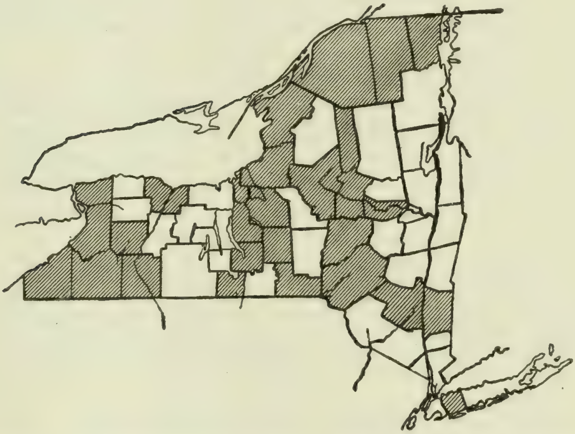
CIRCULAR No. 4 JUNE, 1914

Farm Bureaus of New York State

NEW YORK STATE COLLEGE OF AGRICULTURE, NEW YORK STATE DEPARTMENT OF AGRICULTURE, UNITED STATES DEPARTMENT OF AGRICULTURE, COOPERATING

JEFFERSON COUNTY: AN ACCOUNT OF ITS AGRICULTURE AND OF ITS FARM BUREAU

By F. E. ROBERTSON
Manager of Jefferson County Farm Bureau



The darkened areas show the counties in which farm bureaus had been organized up to June, 1914

Under the Direction of
M. C. BURRITT
State Director of Farm Bureaus

ITHACA, NEW YORK
PUBLISHED BY THE UNIVERSITY

PREFACE

At the present time there is very little complete and specific information concerning the history and status of agriculture in the various counties of New York State, written in popular language and available to the general public. In the belief that such information is wanted both by the residents of the county itself and by persons living outside the county but interested in it, and that the publication of a reconnaissance survey of local agricultural facts and conditions in each county will do much to arouse local pride, to call attention to local problems, and to make known the agricultural advantages and opportunities in a county, a series of circulars has been projected.

It is expected that each of these circulars written by the local county farm bureau manager under the general direction of the State Director of Farm Bureaus, will present a fairly complete statement of the agricultural conditions and possibilities of a county. Besides a brief history of agriculture in a county, each circular will include a description of the local climate, soil, and topography, a statement of population, general business conditions, market facilities, and types of farming practiced, and tables showing total production and unit yields. Desirable systems of farm management will also be pointed out, suggestions will be made, and attention will be called to many important matters on which success in farming depends locally.

The second part of each of these circulars will be an account of the local farm bureau, its organization, and its ability to help in developing local agriculture. Some of the most important functions of a farm bureau association are: the study of local problems with the purpose of finding solutions for them; presenting to the general public in an attractive manner the opportunities for farming in the county; and stimulating local initiative. To increase the net incomes of farmers, thus providing the means of obtaining better schools, churches, and roads, is to promote the welfare of every citizen in the county. Such cooperative effort, properly directed, should also result in a material increase in land values. All these things the parties cooperating in the farm bureau work in New York State desire to promote. This publication, it is thought, will aid the proposed work.

Jefferson county was a pioneer in farm bureau work. The third county in the State to employ a trained county manager, it has been a leader in making the work efficient. Especially in organizing the forces of the community, in conducting effective demonstrations on farms, and in furnishing information to farmers on their own farms, has the work of this farm bureau become widely and favorably known. It has been to a considerable extent a model and an example followed by many other counties. It is well to set forth in detail here the farm conditions and the farm bureau work in one of the leading agricultural counties of New York.

M. C. BURRITT
State Director of Farm Bureaus

JEFFERSON COUNTY: AN ACCOUNT OF ITS AGRICULTURE AND OF ITS FARM BUREAU

PART I

THE AGRICULTURE OF JEFFERSON COUNTY

Jefferson county is situated in the western part of northern New York. It contains within its boundaries the greater part of that world-famous district, the Thousand Islands, and has for its entire northern and western boundary the St. Lawrence River and Lake Ontario. In this section both these bodies of water abound in beautiful shore and island scenery and are yearly increasing in popularity.

By no means should it be assumed that the agricultural resources and opportunities of the county are overshadowed by its æsthetic resources. Rather should it be understood that the beauties of the islands, lakes, and rivers are but supplements to the agricultural and manufacturing resources within the county, and serve by adding completeness to a mental picture of a region well supplied with agricultural advantages, manufacturing opportunities, and pleasant surroundings.

The main purpose of this circular, however, is to tell about the agricultural conditions rather than about the manufacturing enterprises and the natural beauties of Jefferson county, in order that it may serve in some degree to acquaint outsiders with the agricultural status, practices, and opportunities here, so that proper deductions may be drawn by those who sometime may care to make their home in Jefferson county. It is hoped, too, that the circular will not be without value in arousing local pride and in stimulating local initiative.

HISTORY

Jefferson county has much interesting history running back through the days of the French and Indian wars. But the historical facts that relate particularly to people and events are elsewhere recorded [1] and their repetition is not within the scope of this circular. The earliest agricultural history of the county, unfortunately, is none too richly strewn with facts. The amount of historical information relating to agricultural practices that has been handed down in books or by word of mouth is very meager indeed, especially in view of the part that agriculture always plays in the development of any section. Unfortunately this dearth of local agricultural history is characteristic of practically all counties of New York. It is an historic fact that original settlers seldom remain long in non-agricultural districts. It is also true that the inherent fertility of the soil is reflected in some measure in the type of people found thereon.

Homesteads were first taken up in this district from 1795 to 1800. The district was erected under the name of Jefferson County by an act of the Legislature, March 28, 1805. The first Board of Supervisors, representing eight towns, met in the following October for the first time. Active farming has been carried on for somewhat more than one hundred years.

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[1] Jefferson County Sentinel. By Jere Coughlin. 1905.
Our County and Its People. By E. C. Emerson.
History of Jefferson County. By F. B. Hough.
History of Jefferson County. By J. A. Haddock. 1793–1894.
Geographical Gazetter of Jefferson County. By Hamilton Child.

The early settlers were of necessity destructive foresters. In order to obtain tillable land, forests had to be cut away, the trees burned, and the stumps removed. This led to an almost utter disregard for timber and forest growths — whence have come our forestry problems of to-day.

GENERAL INFORMATION

Climate

Owing to its relatively high altitude and peculiar geographical location, the climate of Jefferson county is variable rather than uniform. The mean annual temperature is about 45° F., with an annual range from −37° F. to 98° F.— a difference of 135° F. While the extreme temperatures are exceptional and of short duration, zero weather may generally be expected during the months of December, January, February, and March.

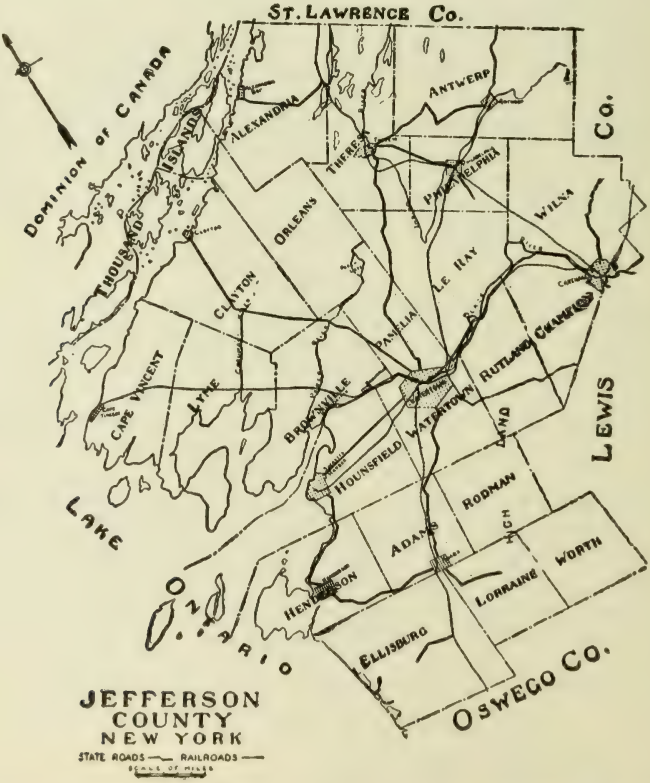

FIG. 6.— *Map of Jefferson county, New York, showing transportation systems and principal towns*

The length of the growing season, when no frosts may be expected, varies in different parts of the county from one hundred and one days in the shortest to one hundred and seventy-five days in the longest seasons on record. The average range of the period without frost is between one hundred and forty and one hundred and forty-nine days. Near the lake shore and the St. Lawrence River the frostless periods approximate fifteen days longer, while in the uplands they average fifteen days less.

According to the records made by the Weather Bureau stations,[2] the variation in precipitation in various parts of the county is more striking than the variation in temperature. The reported rainfall in the part of the county south of the Black River is 48.19 inches, while in the section immediately north of the Black River the average precipitation is 33.99 inches. This marked variation is apparently due to peculiar meteorological conditions associated with the moisture-laden atmosphere sweeping from Lake Ontario over the southern part of the county.

Topography and soils

Topographically the county is divided into two distinct regions, the upland and the lowland (See Figs. 7, 8, and 9). The topography of the upland is hilly as a rule, with an altitude range of 600 to 1750 feet above sea level. This section comprises the greater part of five townships in the southeastern part of the county. The lowland area comprises the greater part of the northern and western parts of the county. Here the topography is flat or gently rolling in nature, with an altitude ranging from 250 to 500 feet above sea level.

A wide variation in types of soil exists. The most extensive type is made up of clay and clay loam. While there are some thirty-five distinct types of soil in the county, the clay loam series occupy more than thirty per cent of the entire area. The greater part of the lowland area is composed of clay and clay loam soil types. Generally these soils are badly in need of drainage. The common practice in draining these soils is to plow in narrow bands 15 to 24 feet wide. In this way a more or less efficient surface drainage is provided. The use of tile for underdraining the soils where they are deep enough is a future work of great importance. The productive power of these cold soils could be greatly increased by good underdrainage. An increase in their value would naturally follow.

The soil types of the upland area are varied, but in general they partake of the stony, gravelly, and shale loam types, most of which are naturally well drained. During the summer of 1911 the United States Department of Agriculture made and later published the results of a soil survey of the entire county.[3]

Vast deposits of limestone underlie the greater part of the county. This limestone is easily available for agricultural uses. Two large plants in the county are now engaged in the quarrying and preparation of burned, hydrated, and ground limestone for agricultural purposes.

Transportation

In the natural order of events in a newly settled country, the trails grew into post roads, the post roads into plank roads and turnpikes. In the year 1850 the first railroad connecting Rome, Watertown, and Cape Vincent was completed. Following the completion of the railroads the plank roads were neglected and finally merged into turnpikes. Before 1860 practically all the other railroads that are now in existence were constructed. At the present time few counties are so well supplied with railroad transportation lines as is Jefferson. Radiating from the city of Watertown, nearly in the center of the county, these roads strike out into practically every part of the county. The greatest markets of the world are within twenty-four hours of any station in the county, while express trains from any part of the county reach the great metropolis of New York in twelve hours.

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[2] Weather Bureau observation stations: Adams Center, Cape Vincent, Philadelphia, and Watertown.

[3] See appended list of references, page 56.

Supplementary to the admirable system of railroad transportation, there is an extensive system of macadamized highways that is rapidly being extended to and through the more inaccessible parts of the county. At the present time there are 109 miles of improved roads and 59 miles of state macadamized roads, making a total of nearly 170 miles of improved roads within the county. These improved roads add materially to the land values, as well as to the profits in farming owing to the reduced marketing costs — to say nothing of the convenience of rapid transportation.

Population

In 1910 the county had a population of 80,382. Fifty-four per cent of this population lived in the city of Watertown (which had a population of 27,000) and in the nineteen incorporated villages in the county. More than half of the population of the county is non-agricultural, hence they are consumers, rather than producers, of foodstuffs. There is in addition the great annual migratory summer population, which spends two weeks to three months at the summer resorts along the lake shores and in the Thousand Island section. While it is not possible to obtain accurate figures as to the amount of this migratory population — since a large part of it arrives from the Canadian side and various water routes as well as from the New York side — it is estimated to be between seventy-five thousand and one hundred thousand annually. This vast multitude is made up of consumers. It will be seen, therefore, that the present local markets, and the possibilities for developing future local markets, for county-grown produce are excellent.

Farm land values, and size of farms

As in most other sections, the land values in Jefferson county vary according to soil, proximity to markets, and transportation facilities. On the whole, considering the natural advantages, transportation facilities, and fertile soil, the average price of farm land is below its actual value. For the past ten years the tendency has been for prices to increase, and the future outlook in this connection is very encouraging.

In the upland parts of the county, land prices range from $20 to $65 an acre. In the southern part prices are somewhat higher — $40 to $80 an acre. In the typical hay country the land values range from $30 to $80, and near the larger villages and along some of the improved roads farms have been sold for $80 to $100, although the latter prices are exceptional.

In the following table the average size of farms in the county and in the State is shown:

TABLE 1.— FARMS AND FARM LAND

	1909	1900
Number of farms	5,778	6,052
Total farm area	732,861 acres	745,093 acres
Total improved area	501,383 acres	526,288 acres
Average size of farms — County	126.8 acres	123.1 acres
Average size of farms — State	102.2 acres	99.9 acres

Non-agricultural industries

Manufactured articles are produced in large quantities within the county, particularly in the city of Watertown and along the Black River, which supplies abundant water power. The manufacturing has chiefly to do with wood pulp and paper industries — for which there are some twenty-three different mills within the county — wagon works, machine shops, and other enterprises. The great amount of undeveloped water power, both on the Black River and on many of the smaller streams, coupled with excellent railroad shipping facilities, offers good opportunities for the establishment and development of commercial enterprises.

CROPS AND CROP PRODUCTION

Only a very small amount of statistical data is available concerning the agriculture of the county previous to 1840. Whatever crops were grown at first found a ready market in the neighborhood, or were needed by the settlers as food for themselves and for their live-stock. Previous to the building of the railroads the commodities that had a cash value were largely forest products, such as ship timber, oak staves, potash derived from burned wood, and the like. These products found a ready market when delivered at Kingston and Montreal, Canada, and at other ports on the lakes and the St. Lawrence River. To a limited extent before the opening of the Erie Canal in 1822, and immediately after that time, considerable amounts of less bulky products were carted overland and marketed at Utica and Albany.

Since the beginning of agricultural activities in the county a number of changes have taken place in regard to the kinds of crops grown. Such crops as winter wheat, hops, seed peas and beans, and the like, have almost disappeared, and their places have been taken by other crops. A study of the history of these crops is interesting. A brief history of the beginning, and the decline or the increase in the culture, of the more common crops follows:

Wheat

From historical records it appears that the first crop of winter wheat in the county was sown in the town of Ellisburg by Lyman Ellis in the fall of 1797, and harvested in the following summer. The then virgin soil of the county was favorable to the culture of wheat, but at the present time wheat-growing has become a precarious enterprise. During the first half of the nineteenth century wheat culture increased until, as shown by statistics, in the year 1844 there were 30,000 acres, yielding about 500,000 bushels. Wheat-growing reached its zenith about 1855 to 1860. From that time its culture declined rapidly. The census of 1910 reported the acreage (including spring wheat) as 398 acres, with a yield of 5,997 bushels. The change was one of necessity rather than one of choice. This is a very interesting example of the rise and decline in production in Jefferson county of one of the most valuable food cereals. Wheat-growing in the county is no longer profitable, generally speaking, owing to the uncertainty of the crop.

Barley

The growing of barley became of considerable importance at an early date. In 1844 the production of barley was 159,873 bushels. From 1850 to 1890 barley was one of the staple grain crops in the county. The maximum production, 500,000 bushels, was reached about 1870. Since 1890 the production of this cereal has declined. The census of 1910 reports 3,575 acres, with a production of 80,141 bushels. Throughout the county numerous malt houses stand as monuments to a once important barley-malting industry. Owing to the decrease in the production of barley the malting of locally grown barley has ceased. As a grain crop barley is now most commonly grown with oats and utilized as food for stock.

Oats

The decline in wheat culture was followed by a marked increase in the culture of oats, a cereal much better adapted to the soil and climatic conditions of Jefferson county. In 1859 the oat production in the county was about equal to that of wheat. Ten years later it was four times as great. The census of 1910 reported the oat crop as occupying 82,864 acres, with a yield of 2,050,568 bushels. The oat crop is now the most important grain crop in the county. At the present time there is a growing inclination on the part of many farmers to improve, by selection and otherwise, their present varieties of oats. This is commendable work and should be encouraged. Other small grains, principally buckwheat, have never reached sufficient development to be considered staple crops.

Corn

The culture of corn was first reported in 1803; but corn was probably grown to some extent before that time, since it constituted an important part of the food of the earliest settlers. The crop has never been extensively grown for grain in this county with any success, owing to the high altitude and to soil types that are not congenial to this semitropical plant. When it is grown for grain the flint varieties are most commonly chosen.

As a fodder crop, however, in connection with dairy husbandry, corn is one of the most important in the county at the present time. Following the rapid development of the dairy industry came the introduction of the silo. During the past twenty years corn for silage has become one of the staple fodder crops of the section. The census of 1910 reports 18,716 acres of fodder corn, with a gross tonnage of 154,324 tons.

Potatoes

The uplands and lighter soils are adapted to potato-growing on a commercial scale, most of the lowland soils being too heavy and compact for this crop. Potatoes have always been grown to a limited degree for home consumption on practically every farm in the county since 1798, when they were first reported in the town of Ellisburg. The census of 1910 reports 5319 acres, with a production of 789,027 bushels. Much the larger portion of the potato crop is consumed locally. There are, however, undeveloped opportunities in connection with seed-potato production for the southern markets.

Hay

The soils and climate of the county are very well adapted for the growing of grasses and hay. Hay has always been extensively grown in Jefferson county, and at present it constitutes the chief cash crop on the majority of farms. Three hundred to three hundred and twenty-five carloads of hay are shipped out of the county each month to such large markets as Boston, New York, and Philadelphia, and to intermediate points. The gross income to farmers from this source ranges between $400,000 and $500,000 yearly. The census of 1910 reports 201,896 acres in hay and clover. Thus the hay crop occupies nearly twenty-five per cent of the farm area within the county. The total yield of timothy, clover, and mixed hay for that year was 177,408 tons. It will be seen that the average tonnage yield per acre is considerably below that of the State, the average for the State being 1.2 ton. There are several apparent reasons for this condition: first, a persistent practice of selling hay from farms not well balanced with respect to live-stock; second, a common practice of permitting meadows to remain in hay too long; and third, the very large acreage averaged. There is very little doubt that under the present system of hay farming the fertility of the more typical hay farms is slowly being reduced.

Clover and grass seed

Formerly large quantities of clover seed were harvested in the county. Of late years this practice has ceased almost entirely, owing to the uncertainty of the clover seed crop and to the difficulty experienced in getting the seed hulled. Very little clover seed is now saved. In fact, on many soil areas considerable difficulty is experienced in getting clover to grow at all. Such soils are usually physically out of condition, poorly drained, and lacking in carbonate of lime.

Grass seed, chiefly timothy, is still grown to a considerable extent, although more for home use than for sale. In recent years the increase in the market value of hay has made it more profitable to sell the hay and buy western seed than to save seed. There are instances, however, when the saving of timothy seed might be good farm economy.

Fruit

Aside from one commercial orchard in the county, very little attention is given to the subject of apple culture. In general the soils are not well adapted to the culture of apples, although with proper attention the fruit could be successfully grown along the lake shore, in the southern part of the county, and on some of the more favorable soil areas in other sections.

The chief reason why more apples are not grown appears to be because farmers do not understand fruit-growing and do not care to venture into the business. Many more apples are consumed than are produced in the county. Both soil and climate, however, are fairly favorable to small fruits, such as raspberries, blackberries, and currants. The local markets for apples, berries, and small fruits are excellent.

Crop yield in 1909

The following table shows the acreage and yields of some of the principal crops in 1909:

TABLE 2.— ACREAGE AND YIELD OF PRINCIPAL FARM CROPS IN 1909

Crop	Acres	Total yield	Yield per acre	Average for State
		(*Tons*)	(*Tons*)	(*Tons*)
Hay and forage	227,856	341,544	1.50	1.40
Timothy alone	58,373	46,206	.79	1.07
Timothy and clover	142,728	129,983	.91	1.09
Clover	795	1,219	1.53	1.30
Alfalfa	120	287	2.39	2.50
		(*Bushels*)	(*Bushels*)	(*Bushels*)
Corn	7,365	240,800	32.7	35.4
Oats	82,864	2,050,568	24.7	26.7
Wheat	398	5,997	15.1	23.0
Barley	3,575	80,141	22.4	24.0
Rye	239	2,461	10.3	15.4
Buckwheat	1,695	32,950	19.4	19.9
Potatoes	5,319	789,027	148.3	123.2
Beans	947	15,632	16.5	14.0
Apples	*79,896	82,413	....	....

*Trees.

The woodlot situation

The disregard of the early settlers for the future of the forest areas is reflected in the present condition of the woodlots and the small forest areas in the county. Practically no thought has ever been given, and no steps have been taken, in the matter of forest preservation or restoration. While the early forests were important sources of wealth to many, little attention is given to the remaining woodlots.

The common method of handling the woodlots in the county is to cut as much fencing material and firewood as are needed, and then utilize the land for pasturage. Practically no attention is given to methods of renovation; in fact, pasturing practically prevents renovation.

While some of the maple forests are being cared for and utilized in the production of maple sugar and sirup, and while a few public-spirited citizens are planting small areas of white pine (*Pinus strobus*), in the majority of cases the remaining woodlots are being rapidly eliminated.

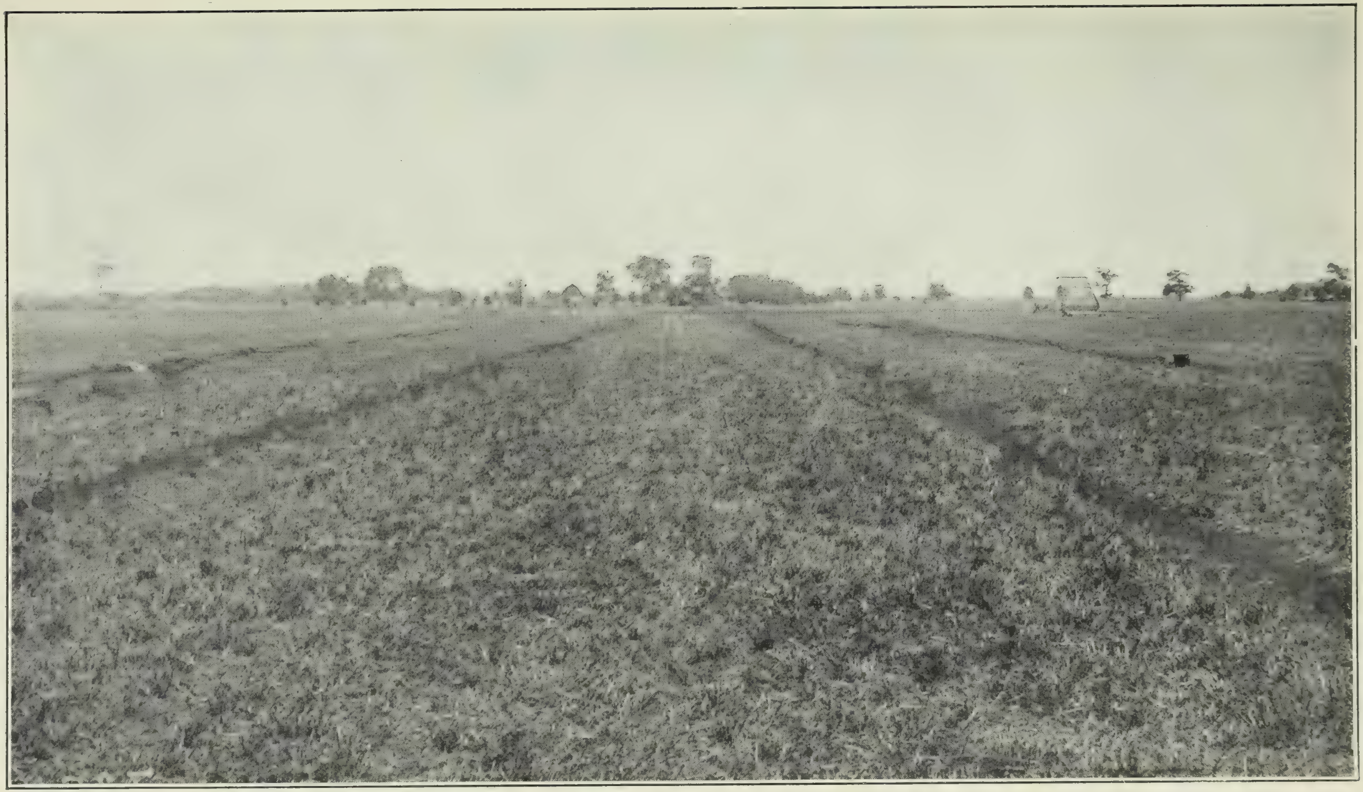

FIG. 7.—*A view in the northwestern part of the county, more or less typical of the level, heavy soils of that section. Hay is the principal cash crop grown here*

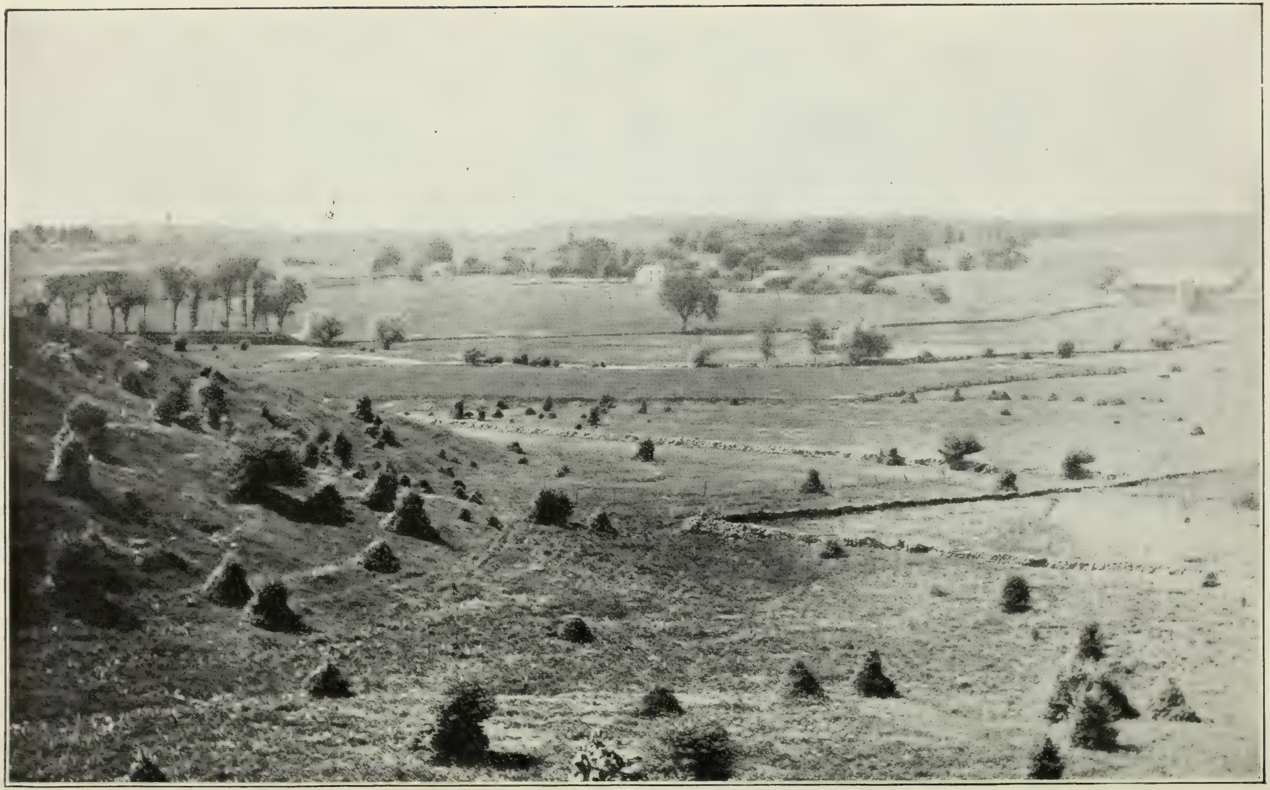

FIG. 8.—*A general view showing the rolling character of the uplands of Jefferson county. There are numerous small, but rather sharp, hills. A large proportion of the land is tillable*

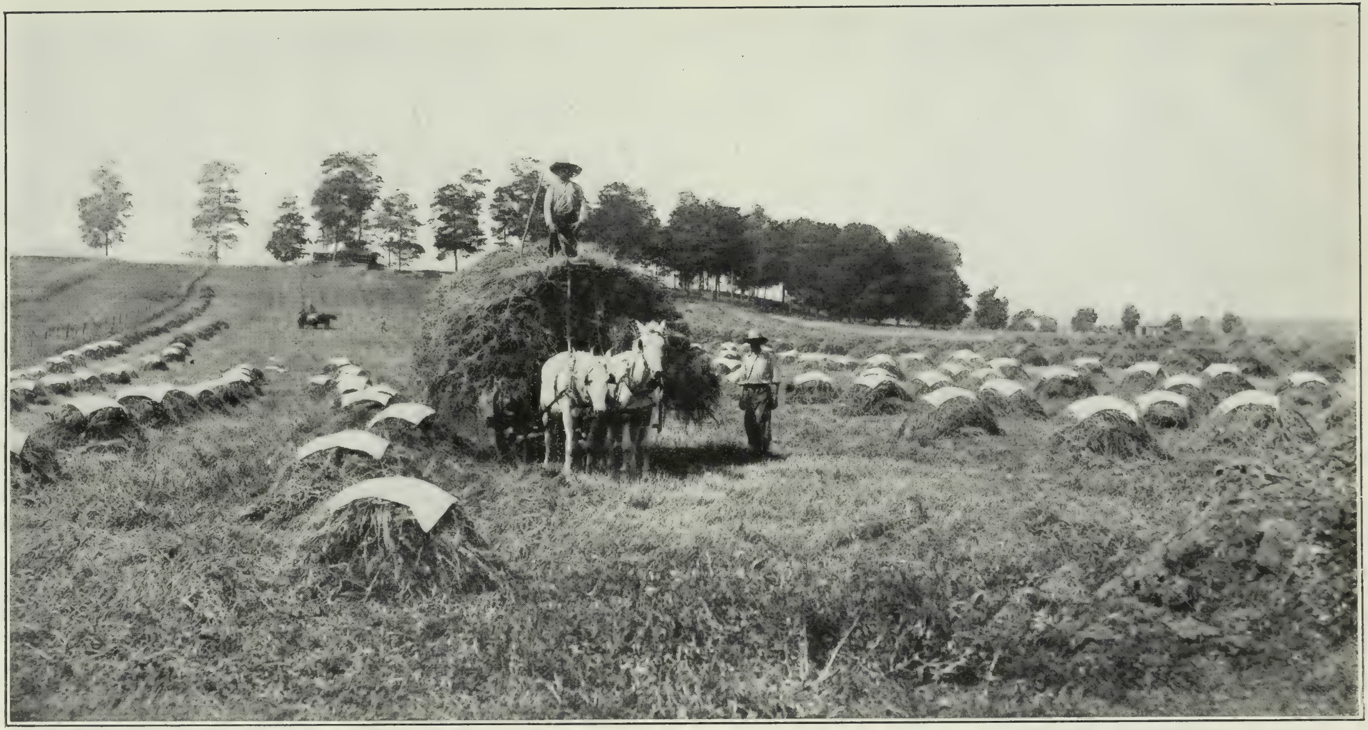

FIG. 9.—*A field of alfalfa on the gently rolling uplands in the southern part of the county. The upland soils are generally lighter, containing more stones. Here hay production is of less importance; more dependence being placed on dairy products, together with potatoes as a cash crop*

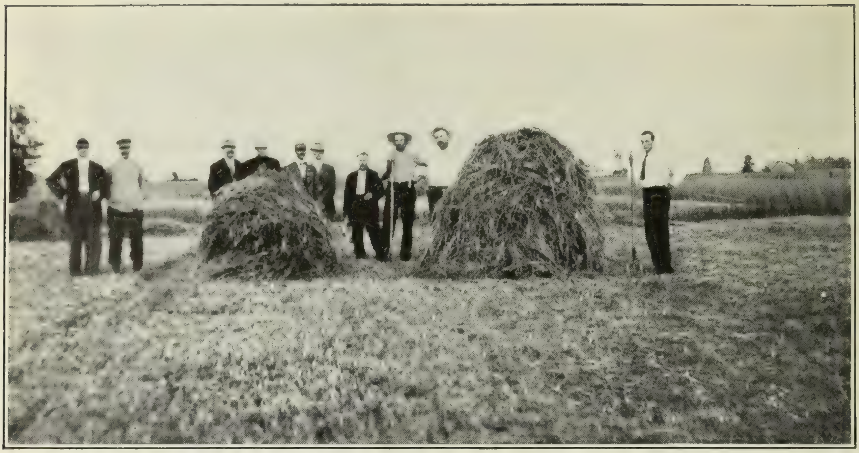

FIG. 10.— *A field demonstration conducted by the Farm Bureau in the hay-growing section of the county, on the use of commercial fertilizers as a top-dressing for hay*

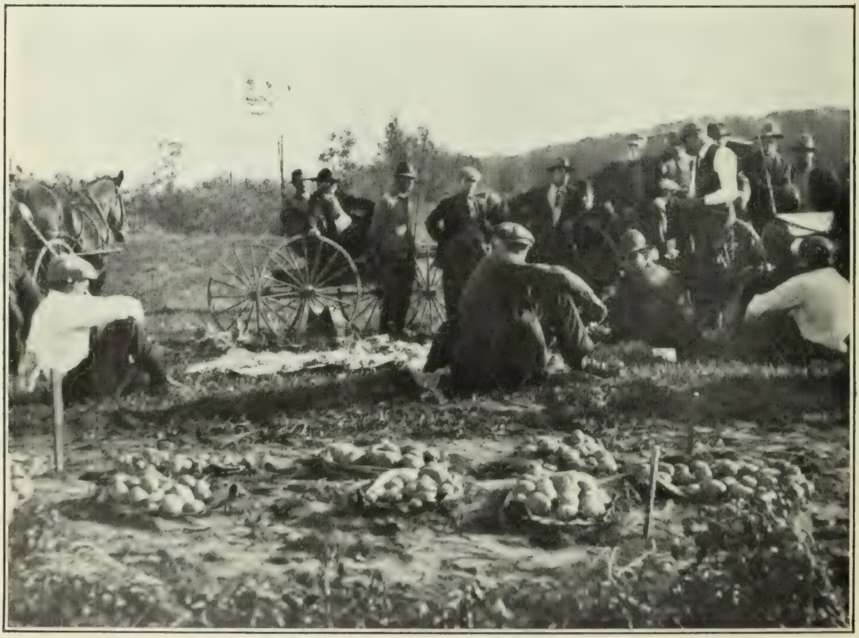

FIG. 11.— *A field demonstration conducted by the Farm Bureau in the potato section of the county, on the selection of seed by the tuber-unit method*

LIVE-STOCK AND ANIMAL PRODUCTS

The live-stock industry has ever been at the foundation of the agricultural activities of Jefferson county. Cattle were first brought from Oneida county as early as 1798. As permanent homes were made, the number of cattle and of sheep increased rapidly. In 1825 there were 100,000 head of sheep. In 1845 this number had increased to 200,000 head, but from that time the number of sheep has steadily decreased, until at present there are not more than 12,000 head in the county. The following table gives the numbers of domestic animals in the county in 1909 and in 1900, showing a slight increase in all kinds except swine:

TABLE 3.— NUMBER OF DOMESTIC ANIMALS

	Horses	Dairy cows	Sheep	Swine	Poultry
1909					
Total number	17,746	64,855	12,059	19,818	230,378
Number per farm	3.1	11.2	2.1	3.4	39.9
1900					
Total number	16,465	63,074	11,579	20,176	206,673
Number per farm	2.7	10.4	1.9	3.3	34.1

Dairy cattle, on the other hand, have steadily increased both in number and in value since the earliest days. In 1845, the number of dairy cows was 31,360. This number, as shown by the census, had increased to 64,855 head in 1910, which places Jefferson third among New York counties in number of dairy cows.

The manufacture of cheese was begun on the farms in 1834, and later was carried on in cooperative cheese factories. In 1849 the cheese production had reached approximately 4,192,000 pounds. In 1908 it had increased to more than 15,000,000 pounds. In addition to this, more than 12,000,000 quarts of whole milk were shipped from the county, not to mention the milk that was made into butter and other products and marketed in the local towns and cities.

The production of market milk has been increased to a considerable degree during the past ten years, by opening new sources of supply from the more distant parts of the State, in order to meet the demand coming from the larger cities for whole milk. Better knowledge of producing and handling whole milk, improved refrigerating service, and rapid transportation have also been factors in developing the market-milk industry in the county. In 1908 there were eighteen butter factories, twenty-two milk-shipping stations, and one hundred and fifty cheese factories in operation. Three milk trains make daily runs from and through the county direct to the larger cities on the seaboard.

The production of market milk has not appreciably affected the cheese-making industry in Jefferson county. The increasing demand for whole milk has heretofore been met by an increase in the number and quality of dairy cows. It is worthy of note that the year 1913 was the banner year in the history of the Watertown Produce Exchange. This Exchange has been in active operation for the past forty years and is unique in that it has the largest inland cheese board in the world.

PRESENT AGRICULTURAL OPPORTUNITIES

In a general way the present systems of farming are well adapted to the climate, soils, and location, although in many respects these systems can be modified with profit. The chief fault of the present systems followed by the majority of the farmers is that they lack diversity, and in some cases the quality of the business done is below what it should be. The men who are keeping unimproved dairy cows and derive the greater part of their yearly incomes from dairy products in the form of market milk and the like, are, on the average, earning low wages. It is entirely practical and possible to improve some prevailing systems, particularly along six different lines:

1. Increasing the average milk production per cow by keeping records of production and discarding the low producers. Cow-testing associations are of great benefit in this connection.
2. Introducing pure-bred breeding stock, especially dairy cattle, the offspring of which has a higher market value than that of grade stock.
3. Increasing the average acre yield of hay, grain, potatoes, et cetera, as cash crops. Shorter rotations, combined with proper seed selection, and tillage will tend to increase yields of all crops.
4. In many cases, by farming more land so that the labor of men, teams, and tools will be more profitably utilized throughout the year. Adjoining farm land may be purchased or rented. Too many small farms are overburdened with equipment that is used for but a short time in a year.
5. Practicing greater diversity in order to develop more important sources of cash income; for example, a typical dairy and hay farm could keep pure-bred cows, raise colts from draft mares, grow choice seed oats for sale, and develop other minor products that might be turned into cash.
6. It is an interesting fact that there is always a demand for good seed. In this line of work there are unlimited opportunities and practically no competition in Jefferson county. The production of high-grade seed oats, native varieties of corn, and selected strains of potatoes, both for the local and for neighboring markets, bids fair to become a line of business of great importance.

TYPES OF FARMING AND CROP ROTATIONS

During the past one hundred years of more or less active farming, the types or systems followed have changed from time to time, owing chiefly to the relatively less profit from wheat, barley, seed peas, beans, et cetera, as compared with hay. New market requirements, insect ravages, and soils depleted in certain respects have also been factors in bringing about changes in types of farming. Finally, out of past experience there has been evolved a system of farming with the production of live-stock, dairy products, and market hay as the foundation. This type of farming is followed chiefly in the lowland section of the county.

In the upland district and on the lighter soil areas, hay production assumes less importance, and more dependence is placed on dairy products together with potatoes as a cash crop.

In other less extensive areas, as along the lake and river shores, a combination of general farming and market gardening is followed. Owing to the present good local demand there are excellent opportunities, where the soils are favorable, for the development of market gardening and poultry-raising as adjuncts to the regular farm enterprises. In the growing of early and late potatoes, muskmelons, onions, cabbages, and other truck crops, there are opportunities becoming more apparent each year as the local consumption and the summer resort trade increase.

The dairy industry of the county is a vast business, in spite of the fact that the average production per cow is low. In this line alone there is opportunity for great improvement, especially in the individual cow.

In the potato sections there are undeveloped opportunities in the growing of standard varieties for the southern seed-potato trade.

There are really two commonly practiced rotations. On the heavy soil areas, where hay is the chief cash crop, the rotation is a comparatively long one, in which clover is often of secondary importance. This rotation consists of corn for silage or oats on sod, followed by oats and barley, with which the clover and grass seeds are sown. Oats are frequently grown for two years in succession on the same field. The common rate of seeding is two quarts of clover and eight quarts of timothy, although the most successful farmers are using four to six quarts of clover and ten to twelve quarts of timothy an acre. The meadows are cut from three to five years.

In the upland district the rotations consist of corn or potatoes on sod, followed by oats, then clover, and one to three years of grass.

FARM MANAGEMENT

During the summer of 1911 a farm survey was made in the county by the State College of Agriculture. In this survey all the farms in five townships were visited, and statistics relating to the year's business were gathered. The weather and market conditions were such that the year was a normal one. From this mass of information some very interesting and important facts have been brought to light relating to the profits from farming in Jefferson county. It was found that operators who followed certain systems of farming received higher wages for their labor than the average, and that these systems embodied certain principles of good farm management, which are rewarded with greater average profits practically everywhere.

It is conclusively shown that there are four important factors to be kept in mind if farm profits above the average in the county are to be secured. These are:

1. Production of crops and stock production. On farms where production per cow and yields of crops are above the average, the labor incomes are above the average.

2. Size of business. Farms of two hundred acres or more are more profitable than those under this size, and the profits made are in proportion to the amount of business done.

3. Diversification. Farms with little else than market milk to sell are making less than farms producing milk in combination with one or more cash crops, such as hay, potatoes (on potato soils), oats, and sometimes other crops. Poultry and pure-bred Holstein cattle also combine well with these.

4. A combination of any two or more of these factors permits larger profits to be made than when one factor only is employed. In other words, the quality of the business done, the size of the business, and the extent to which the business is diversified, are all important factors in farming for profit in Jefferson county. When these principles are put into operation, the greatest efficiency of man and horse labor and the best use of machinery, equipment, and capital is attained. These factors can perhaps be most concisely and clearly expressed as follows:

Average labor income from 670 farms, average size 143 acres, season of 1910	$609
Average labor income from 23 farms with best cows and crop yields	$994
Average labor income from 71 largest farms (more than 200 acres in size)	$1,044
Average labor income from 31 largest farms, with cows and crops as good as, or better than, the average	$1,567
Average labor income from 13 largest farms, with cows and crops as good as, or better than, the average, and which in addition were diversified	$1,968

PART II

THE JEFFERSON COUNTY FARM BUREAU

During the winter of 1912 some of the leading men in Jefferson county, acting through and in conjunction with the board of supervisors, decided to organize a county institution known as a farm bureau. In this work the cooperation and support of the United States Department of Agriculture, the New York State Department of Agriculture, and the State College of Agriculture, was solicited and obtained.

The farm bureau movement has in view several important lines of work, chief of which are as follows:

1. To federate community agricultural interests. In each county there are developed, in a greater or less degree, various agricultural agencies and interests such as the county fair association, live-stock breeders' association, granges, and various other societies, all striving, in a more or less independent and unconcerted manner, to better their conditions. How much more could be accomplished, were these independent interests federated and striving together for certain definite desired objects! It is part of the work of the farm bureau to bring about such a federation.

2. To organize community forces. In every county there are undeveloped forces and enterprises awaiting organization; for example, a general production of good seed oats, potatoes, corn, et cetera, in quantity and the development of a reputation for the same, the breeding of horses for local use, improvement of dairy cattle, community drainage enter-

prises, standardization of the croppage, and various other projects. These forces should be developed, and it is the purpose of the farm bureau to assist in organizing and promoting them.

3. To give encouragement and aid in the development of community buying and selling, and especially to bring buyers and sellers into closer touch. The prices that the consumer pays for most of the products that he needs range from forty to sixty per cent above the price that the producer receives for the same products. On the other hand, the price that the producer receives for his products is frequently less than half the value for which his goods are sold. By no means is all of this difference paid for transportation. Each one of the various agents who purchase, handle, and retail the different commodities makes a profit on the transaction, thereby adding materially to the ultimate cost of the product to the consumer. It is part of the work of the bureau, in cooperation with producers, to simplify and reduce the costs and difficulties of marketing farm products by bringing the consumer and the producer into closer relation.

4. To study local economic conditions. In every community there are economic problems having to do with cost of production, cost of transportation, unproductive investments of capital, labor scarcity, and the like, that often have a vital effect on the status of agricultural activities. It is a part of the duties of the bureau to investigate such conditions, and, in cooperation with others, to learn how economic handicaps may be removed and to aid in bringing about desired improvements.

5. To demonstrate better farm management and farm produce. Great improvement can be made in almost any county in the matter of better farm practices and more profitable systems of farm management. The adoption of the proper improved methods results in greater average farm profits. It is one of the functions of the bureau to point out and to demonstrate in a practical manner, from time to time and in different parts of the county, such of these better methods as may have pertinent application, as, for example, the use of lime, shorter and more suitable rotations, and the like.

6. To give advice and assistance as called for on various agricultural subjects. The farm bureau is called upon for a large amount of advice and detailed explanation as to practices. In order to cover the field, the county manager must have had a considerable amount of practical experience, coupled with technical knowledge of many agricultural matters. Especially in the beginning, the greatest demand on the time of the county manager comes from this source. Questions concerning the details of the use of spraying mixtures, fertilizing formulas, plant improvement methods, the best cultural methods, and the like, must be met with specific replies on the part of the county manager. Yet this line of work is by no means the most important that should occupy his attention. His greatest usefulness should be in developing the other lines mentioned above.

ORGANIZATION

The Jefferson County Farm Bureau was organized on April 14, 1912, with headquarters in connection with the Watertown Chamber of Commerce. The Bureau is supported by a fund amounting to $3680, cooperatively contributed as follows:

United States Department of Agriculture	$1,020
New York State Department of Agriculture	600
Jefferson County Board of Supervisors	1,000
Chicago Crop Improvement Committee	1,000
New York Central and Hudson River Railroad Company	60

In addition to these sums the Bureau receives gratuitous privileges from the Chamber of Commerce in the way of office facilities, and from the New York Central and Hudson River Railroad Company in the form of a pass for the county manager over its lines within the county. The money of the Crop Improvement Committee is being used as an endowment fund.

The bureau organization elects the following officers: president, vice-president, secretary and treasurer. There are also an executive committee composed of seven members, who appoint the manager, and an advisory committee composed of one representative from each subordinate grange or town in the county. The latter is a very important committee and has some thirty-five members.

The duties of these several officers and committees are set forth in a regularly adopted constitution and set of by-laws, copies of which may be obtained from the local farm bureau manager.

METHODS OF WORK AND ACCOMPLISHMENTS

As the Jefferson County Farm Bureau was one of the first to be organized, little precedent had been established and there was little knowledge in regard to the lines of work that were of greatest importance to follow. It was a new field. The work to be done and the methods to be employed in doing it had to be planned as the field was cultivated. During the past two years, much experience, to which Jefferson county has contributed its full quota, has been gained in respect to the more important lines of work that the county agricultural manager should do.

The first work in Jefferson county was such as tended to acquaint the manager as intimately as possible with the people and with agricultural conditions. This was accomplished at first by visiting the various granges and by driving about the county interviewing farmers. From the first, requests from farmers to visit their farms were numerous. The farmers' objects were mainly to discuss various topics relating to their problems, with the expectation of obtaining advice. Visits to farmers are now made on invitation from the owner, or occasionally where a particularly commendable piece of work is being done.

It has been the purpose of the Farm Bureau to spread the gospel of better farm practices by field demonstrations. These field demonstrations consist of many lines of work; for example, effects of spraying potatoes, potato seed selection, variety tests of corn, value of chemical fertilizer in top-dressing meadows, et cetera. Farmers are aided in undertaking various lines of work according to their needs and liking. When results are apparent — as, for instance, when the crop is ready to harvest — the neighbors are invited to call at a particular time and see the results.

At such time very little explanation of the evidence is necessary in order to create a favorable impression, if not to convince.

In addition to the demonstration work, a certain amount of community work and organization of different forces is being undertaken in connection with the county district school superintendents. Farm boys' corn and potato clubs have been organized. This work, while given the support of the Bureau, is largely under the control of each school superintendent in his district. This particular line of work represents very well the opportunities for the federation of local effort which may be carried out to good advantage.

Cow-testing associations have been organized with the cooperation of the New York State Department of Agriculture. There is a vast amount of work to be done in improving the dairy herds in Jefferson county, and, while these few associations are but a beginning, they open the field to future action along this line.

During the two years of the existence of the Bureau, work has been limited in some degree by the fact that the only means of transportation was horse and wagon. During this time, however, more than twelve hundred farmers have been visited, principally on request. Recently the Bureau has acquired an automobile, which will enable the manager to work more efficiently.

It has been the practice of the manager to visit the different granges within the county, and other organization meetings, for the purpose of conveying some messages relating to the local problems. It has always been the policy of the Bureau to use illustrative materials as much as possible at these meetings. Since the Bureau was organized, one hundred and forty addresses have been given before granges, farmers' institutes, and other meetings.

In cooperation with the county agricultural society, the Bureau has for the past two seasons held exhibits and maintained demonstration plots on the county fair grounds. It has also instituted and fathered farm boys' stock-judging contests during the week of the county fair.

Field demonstrations in connection with the use of lime and fertilizer, plant-breeding, seed selection, ditching demonstrations, and orchard improvement, have during the past two summers occupied a considerable part of the time. In addition to holding the local field meetings, results of the field experiments have been published in the form of local bulletins. Four of these local bulletins,[4] each having an edition of between five hundred and six hundred copies, have been issued and distributed. These bulletins are to be reprinted as necessary for recording and reporting local progress and achievements along the various lines in hand.

The county press is used almost weekly as a medium through which to issue important agricultural press notices, timely articles, and the like.

In cooperation with the State College of Agriculture, two extension schools of agriculture have been held, and one plant improvement demonstration train has been run through the county reaching more than sixteen hundred persons. Some plant-breeding work and seed dissemination has been started, particularly in connection with the improvement of the hay, oat, potato, and corn crops.

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[4] See appended list of references, page 2276.

A considerable amount of field work has been done along the following lines: suggested improvements in rotation practices, trials of legumes such as alfalfa, soy beans, vetch, et cetera, orchard pruning and spraying, pasture improvement, weed-spraying demonstrations, drainage systems, farm accounting.

The Bureau has always maintained a labor employment department, handling in particular such supplies of local farm labor as were available. During the past two years more than two hundred farm hands have been put into touch with farmers through this exchange.

The Bureau has also started a pure-seed and live-stock exchange for the use of local farmers. Here different kinds of live-stock and seeds may be recorded for sale; here persons wanting live-stock, good seed, et cetera, by sending a postal at a cost of one cent, may receive in return a list of persons having for sale the commodities that they need.

A limited amount of strictly local investigative work is being carried on. But the chief aim of the Bureau is to develop effective demonstrations and better organization of the local forces. During the past two years the manager of the Bureau has come into contact, directly or indirectly, with at least one half of the farmers in the county. It is not to be expected that the agricultural practices in any county will be materially changed through exhortation alone, or that large financial benefits will necessarily result to farmers in a short space of time except in very rare and exceptional cases. Any changes in farm practices or farm management should be brought about slowly — as a matter of fact it is difficult to change them rapidly — in order not to disturb the agricultural stability of the section; and it necessarily follows that any profits that may result to farmers from such changes will appear slowly.

SUMMARY OF PRINCIPAL LINES OF WORK IN PROGRESS AND COMPLETED DURING 1912-1913

1. Three cow-testing associations were organized in cooperation with the State Department of Agriculture, comprising 80 herds, with 1700 cows.
2. A farm boys' corn- and potato-growing contest was organized each year. In the first year more than $200 was raised toward prizes.
3. Two extension schools of agriculture were organized and held in cooperation with the State College of Agriculture.
4. A live-stock and seed exchange was established, beginning January 1, 1914.
5. Two stock-judging contests for farm boys were organized and conducted at the county fair. Also, demonstrations and displays were made on the county fair grounds.
6. Twelve hundred farmers were visited on their farms, for the purpose of personal consultation concerning various farm problems.
7. Addresses were made at one hundred and fifty farmers' meetings and granges, reaching approximately four thousand persons.
8. In cooperation with the State College of Agriculture, the Bureau undertook the following work:
    (a) Helped to run one plant-improvement demonstration train.
    (b) Distributed improved varieties of timothy seed among twenty-five farmers.

- (c) Started work in potato-improvement by seed selection with one hundred farmers.
- (d) Began improvement of strains and varieties of oats with six farmers.

9. Eighteen field demonstrations were held, reaching three hundred and sixty farmers.

10. Ninety articles on various agricultural subjects were written for the local press.

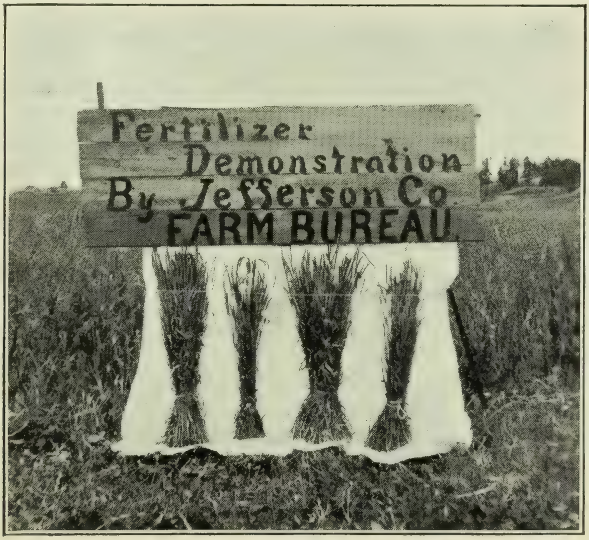
11. Four farm bureau bulletins, and six circulars on local agricultural problems, were written and published.

12. A farm bureau labor exchange was established, assisting two hundred farmers or more in obtaining laborers.

13. The following field trials with various crops have been made and are being carried on:
    - (a) Variety tests with corn, three farmers.
    - (b) Field trials with soy beans for seed and silage, twenty farmers.
    - (c) Field trials with winter vetch, eight farmers.
    - (d) Field trials with fertilizers top-dressing meadows, six farmers.
    - (e) Alfalfa variety tests (Grimm and Turkestan), five farmers.
    - (f) Lime demonstrations under way, twenty farmers.
    - (g) Work in pasture improvement started, five farmers.
    - (h) Weed-spraying demonstrations, four farmers.

14. Addresses were made at twenty-six farmers' institutes, with an attendance of eighteen hundred farmers.

15. Assistance was given in planning crop rotations, pruning and spraying orchards, treating oats for smut, soil improvement work, farm accounting, drainage work, and various other lines of activity.



TEN WAYS IN WHICH A COUNTY FARM BUREAU CAN HELP YOU

1. By furnishing you with the best information available about the growing and selling of your crops.

2. By conducting experiments and demonstrations in your locality, so as to find out and make evident beyond a doubt the best farm practices.

3. By bringing your most difficult problems to the attention of experts, and by bringing experts to your farm or locality.

4. By assisting you to analyze your business by the survey and accounting methods, so as to find the weaknesses and the strong points.

5. By suggesting changes in your farm management and practice based on the collective experience of your neighbors.

6. By aiding you to obtain cheaper supplies, such as lime, fertilizers, and seeds, by promoting cooperative buying organizations, and by disseminating information about prices and quality.

7. By helping you to obtain better prices for your products through promoting farmers' cooperative selling organizations, and by disseminating information as to crop yields and prices, packing, and marketing.

8. By answering your specific questions, and by giving advice when asked or by obtaining this service for you from others.

9. By promoting efficient farm and community organization, as well as by increasing the local efficiency of all agricultural institutions.

10. By helping your neighbors in all these ways; by making known the agricultural advantages of your county, thereby tending to increase land values and local facilities.

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  Improving the potato crop by seed selection.
  Some simple means for improving the oat crop.
  Farm boys' corn and potato contest. Rules and prize list.
  A report of the County Farm Bureau Association.

Home Economics Agronomy Main, or Administration Dairy

The College of Agriculture: central group of buildings

THE
BUILDINGS, LANDS, AND ACTIVITIES
OF THE
New York State College of Agriculture
AT CORNELL UNIVERSITY

ITHACA, NEW YORK

FIRST EDITION
1914

This guidebook, or handbook, has been prepared by the Editorial Office in collaboration with the several departments of the College of Agriculture.

A. R. Mann, Editor

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DIRECTORY OF DEPARTMENTS OF THE NEW YORK STATE COLLEGE OF AGRICULTURE

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Secretary's Office	Main Building, Room 122	A. R. Mann
Business Office	Main Building, Room 103	G. W. Parker
Agricultural Chemistry	Morse Hall, Room 75	G. W. Cavanaugh
Animal Husbandry	Animal Husbandry Building	H. H. Wing
Botany	Agronomy Building, Room 302	K. M. Wiegand
Dairy Industry	Dairy Building, Room 102	H. E. Ross
Drawing	Dairy Building, Room 302	W. C. Baker
Entomology	Main Building, Room 352	J. H. Comstock
Extension Teaching	Main Building, Room 164	Public Office
	Main Building, Room 195	C. H. Tuck
Farm Crops	Agronomy Building, Room 164	E. G. Montgomery
Farm Management	Poultry Building, Room 252	G. F. Warren
Farm Practice	Agronomy Building, Room 168	J. L. Stone
Floriculture	Main Building, Room 222	E. A. White
Forestry	Home Economics Building, Room 360	Walter Mulford
Home Economics	Home Economics Building, Room 135	Flora Rose and Martha Van Rensselaer
Landscape Art	Landscape Art Building	Bryant Fleming
Meteorology	Main Building, Room 442	W. M. Wilson
Plant-breeding	Agronomy Building, Room 301	A. W. Gilbert and H. H. Love
Plant Pathology	Auditorium, East Basement	H. H. Whetzel
Pomology	Main Building, Room 201	C. S. Wilson
Poultry Husbandry	Poultry Building, Room 200	J. E. Rice
Rural Economy	Auditorium, North West	G. N. Lauman
Rural Engineering	Rural Engineering Building	H. W. Riley
Rural School Education	Schoolhouse	Alice G. McCloskey
Soil Technology	Agronomy Building, Room 211	T. L. Lyon
Vegetable-gardening	Auditorium, North East	Paul Work

FOREWORD

In 1909 the College of Agriculture published a small pamphlet, called a " Guide to the New York State College of Agriculture at Cornell University," which, while inadequate because of its brevity, was of much value to students and visitors. The present volume is its successor. The attempt is here made to describe succinctly the more general aspects of the buildings, lands, and activities of the College, and to provide at once a book which students may carry with them as they go over the farms, which will direct the constantly increasing number of visitors in their inspection of the college domain and will answer many of their questions, and which will provide a means of relief in answering certain types of correspondence. It is anticipated that this volume, like its predecessor, will be found inadequate in many respects; but it is the intention to revise the volume at frequent intervals and thereby gradually to perfect it. Because of the rapid growth of the College in students, staff, equipment, and activities, and the resultant changes in the locations of departments, this volume will quickly become inaccurate in some measure; but it will answer the major demands for a sufficient time to justify its publication, and it will serve as a book of record.

Established as a state college in 1904, defined as to scope and administration in 1906, the first new building of the new state group dedicated in 1907, the College of Agriculture has now attained to such dimensions in the physical plan and to such fullness of organization as to empower it to begin to realize the desires of the people of the State in its establishment. The buildings now in process of construction and in contemplation for the immediate future are parts of a definite plan, and are such as are necessary to enable the institution to meet the obligations and responsibilities imposed by law. To present a brief description of this plan and to state the organization and activities of the institution are the purposes of this handbook.

The quantity of material that has demanded place in this guide has become very great, notwithstanding the effort to keep the book small in order that it should be convenient for carrying. Despite the size to which the volume has attained, much that would add interest and value has been left unsaid or has been presented in barest outline. Visitors using the book are encouraged to inquire further from members of the staff concerning any matters in which they have special interest. Such inquiries are a satisfaction to officers of the College, and visitors should have no hesitancy in seeking personal advice and direction.

The table of contents and the index to illustrations, to be found in the preceding pages, and the general index at the end of the volume, have been made in much detail in order to facilitate reference. Much time will be saved to strangers by liberal use of these helps and by consulting the numerous maps to be found in the book.

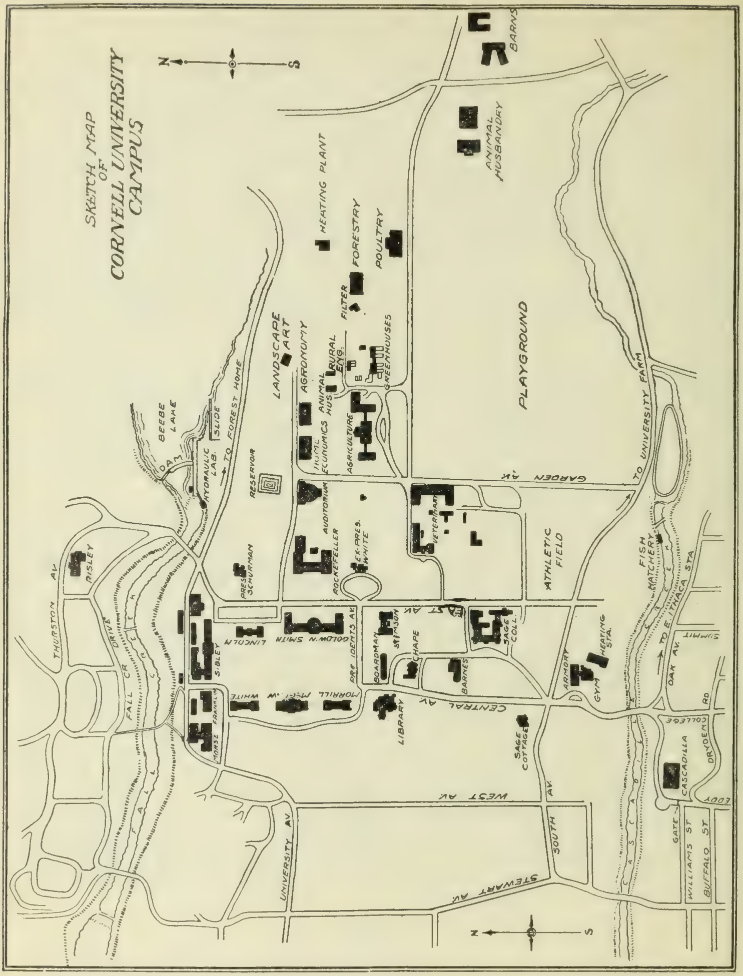
CORNELL UNIVERSITY

Cornell University was incorporated by the Legislature of the State of New York on April 27, 1865, and was opened on October 7, 1868. The existence of the University is due to the combined wisdom and bounty of the United States, the State of New York, and Ezra Cornell.

Under the terms of the Congressional Land-Grant Act, approved on July 2, 1862, New York State received as its share of public lands 990,000 acres. The scrip was delivered to the Comptroller, who was authorized, by the act passed on May 5, 1863, to receive it and with the approval and concurrence of other state officers to dispose of the whole or any part of it for cash, or for stocks of the United States or of the States, or for some other safe stocks yielding not less than five per cent. Under this act 8,000 acres were sold at 83 cents and 68,000 acres at 85 cents, producing together $64,440. But since other States were offering their scrips at a much lower rate the sales soon ceased.

Meantime Ezra Cornell was dreaming of a project which he had come to formulate in the memorable words, "I would found an institution where any person can find instruction in any study." By a union of his own resources with the proceeds of the Land Grant he saw a way to the realization of his purpose. This union was effected by the act of April 27, 1865, establishing Cornell University and appropriating to it the proceeds of the sale of the public lands granted by Congress to the State of New York.

Ezra Cornell's direct donation to the University was $500,000, 200 acres of land with useful buildings, and several smaller gifts for special purposes. His largest contribution, however, came in the shape of profits eventually made by the University on the land scrip which he purchased from the State. Of the New York scrip no further sales had been made by the Comptroller prior to the autumn of 1865, when Ezra Cornell purchased 100,000 acres for $50,000 on condition that all the profits which should accrue from the sale of land should be paid to Cornell University. By an act of the Legislature passed on April 10, 1866, the State had authorized the Comptroller to sell the scrip remaining unsold, that is to say, a scrip for 813,920 acres, to the trustees of Cornell University at a price of not less than 30 cents per acre; and in case the trustees should not agree to make the purchase, the Legislature had further authorized the sale "to any person or persons" on the terms above named, provided that proper security should be given that "the whole net avails and profits from the sale of scrip" should be paid over and devoted to the purpose of Cornell University. The trustees were not in condition to make the purchase. After some delay Mr. Cornell agreed to take the scrip at 30 cents per acre, with an addition of 30 cents if he should realize that sum on the sale of the land.



Campus of Cornell University

Mr. Cornell sold scrip for 381,920 acres, at prices varying from 85 cents to $1 per acre, the total receipts being $357,748.61. With the remaining scrip for 532,000 acres he located 512,343.65 acres; and of the land thus located he sold 111,046.86 acres for $470,364.88. The residue of the land he carried until October, 1874, when a new agreement was made, with the consent of the proper state officers, in virtue of which " the Cornell University " was to take the place and assume the duties and obligations of Ezra Cornell, in his contracts with the State made in November, 1865, and August, 1866, accepting from him a conveyance of his entire interest, and all his rights under such contracts, and of all the lands located by him with college scrip, and paying at once in cash to the Comptroller the full amount of Cornell's bond to the State, principal and interest, and henceforward assuming the burden of the care, management, and sale of such lands. The University thus took the place of Ezra Cornell in his contracts with the State. From the lands handed over by Mr. Cornell — 401,296.79 acres — the Board of Trustees, through the agency of its Land Committee, has already realized a net return of about $5,000,000. On May 19, 1890, the absolute ownership by the University of the Cornell Endowment Fund was established by the decision of the Supreme Court of the United States, affirming a decision of the New York State Court of Appeals.

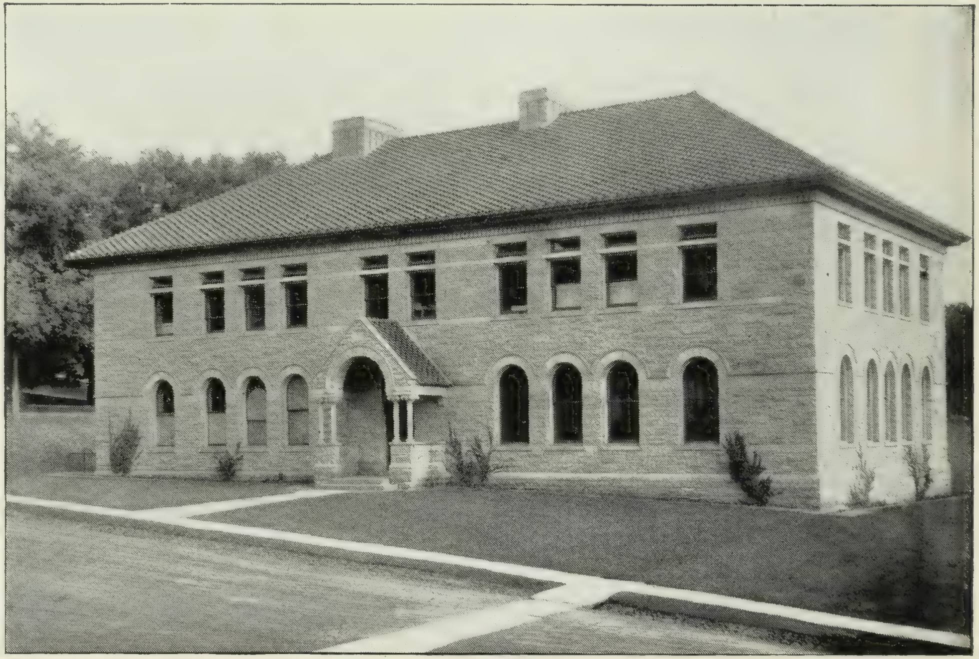
The College Land Scrip Fund amounts to $688,576.12. By chapter 78 of the laws of 1895 this fund was turned into the treasury of the State, and a certificate of indebtedness for an interest thereon of five per cent annually was issued to Cornell University by the State, conformably to the conditions of the act of Congress of July 2, 1862, under which the donation of public land was made.

Cornell University comprehends the following departments: the Graduate School, the College of Arts and Sciences, the College of Law, the College of Medicine, the New York State Veterinary College, the New York State College of Agriculture, the College of Architecture, the College of Civil Engineering, the Sibley College of Mechanical Engineering and Mechanic Arts. The New York State College of Agriculture and the New York State Veterinary College are administered by Cornell University, and their work is organically connected with that of the University.

The officers of instruction of Cornell University number nearly seven hundred. The campus and grounds of the University cover eleven hundred and eighty-one acres. The main university buildings in Ithaca are grouped around a great quadrangle flanked by Goldwin Smith Hall (history, languages, philosophy, and allied branches), Lincoln Hall (civil engineering), Sibley College (mechanical engineering), White Hall (architecture, mathematics), McGraw Hall (geology, vertebrate zoology), Morrill Hall (administration building), the University Library, Boardman Hall (law), and Stimson Hall (medicine), with Franklin Hall (electrical engineering), Rand Hall (pattern and machine shops), Morse Hall (chemistry), Rockefeller Hall (physics), the buildings of the College of Agriculture, the Veterinary College, the Astronomical Observatory, the Gymnasium, and the Armory conveniently near. The Cornell University College of Medicine in the city of New York is located on First Avenue between Twenty-seventh and Twenty-eighth Streets.

The total attendance of students by years since the University was opened has been as follows:

1868,	412	1877,	529	1886,	829	1895,	2,057	1904,	3,841
1869,	563	1878,	505	1887,	1,022	1896,	2,105	1905,	4,122
1870,	609	1879,	463	1888,	1,229	1897,	2,120	1906,	4,225
1871,	597	1880,	399	1889,	1,329	1898,	2,543	1907,	4,465
1872,	539	1881,	384	1890,	1,390	1899,	2,766	1908,	4,859
1873,	509	1882,	405	1891,	1,670	1900,	2,980	1909,	5,194
1874,	532	1883,	447	1892,	1,883	1901,	3,293	1910,	5,624
1875,	542	1884,	575	1893,	2,040	1902,	3,457	1911,	5,848
1876,	561	1885,	649	1894,	2,042	1903,	3,423	1912,	6,311



Original dairy building. The first building erected by the State, and for many years the only classroom building used exclusively for agricultural work

HISTORICAL SKETCH OF THE COLLEGE OF AGRICULTURE

Instruction in agriculture at Cornell University, and in the branches allied thereto, began with the opening of the University in 1868. By the terms of the Congressional Land Grant, or Morrill Act, on which Cornell University was founded, and by the terms of the charter, the University is obliged to give instruction in agriculture and the mechanic arts. At that time very few institutions of college grade in the United States were attempting to give instruction in agriculture. The ideas relating to such instruction were necessarily vague and all attempts were largely of an experimental nature. In this respect the history of Cornell University is not greatly different from that of related institutions in other States the establishment of which was due to the same Land Grant Act.

At the opening of the University, as laid down in the first Register, three distinct courses were offered: one of four years, leading to the degree of Bachelor of Science; and shorter ones, of three years and two years respectively, leading to no degree. These courses outlined a fairly thorough course of instruction in the natural sciences, with more or less of mathematics and languages and a comparatively small amount of practical instruction in technical agriculture. The titles of four professors in the original faculty bore some reference to agriculture in one way or another. These were: Lewis Spaulding, Assistant Professor of Agriculture; George C. Caldwell, Professor of Agricultural Chemistry; Albert N. Prentiss, Professor of Botany, Horticulture, and Arboriculture; and Dr. James Law, Professor of Veterinary Medicine and Surgery. With the exception of Professor Spaulding these men remained connected with Cornell University, giving instruction in various branches of agriculture, Professor Caldwell and Professor Prentiss until their death and Professor Law until retired by the age limit.

The first University Register catalogued thirty students pursuing studies in agriculture; and, while for many years the number remained small and more or less fluctuating, yet at no time since the opening of the University have there been no students in agriculture or agricultural subjects. From the first, also, a definite College of Agriculture, among other colleges in the University, was recognized in official publications of the University. For many years—until 1896—this organization into colleges was very vague. The so-called colleges were composed of groups of related departments, the heads of the departments acting as the college faculty; but their functions were almost entirely those of an advisory committee, since all details of administration in all the colleges were in the hands of the university, or general, faculty.

Professor Spaulding, the first professor of agriculture, retained his connection with the University for only two years. During the third year of the University there was no professor of agriculture, but the Register stated that instruction in practical agriculture would be provided in numerous short courses of lectures by nonresident instructors chosen from among the more successful farmers and agriculturists of the State. This method of instruction does not seem to have been satisfactory, and in the University Register for the year 1871–1872, the fourth year of the University, the appointment of Henry H. McCandless as Professor of Agriculture was announced. Professor McCandless was an Irishman, a graduate of the Glasnevin School near Dublin, who, according to the Announcement, came to the University with the expressed intention of teaching better, and particularly more intensive, methods of the cultivation of the soil, similar to those practiced in England and Scotland. Professor McCandless remained only two years. He was succeeded by Isaac P. Roberts, who was appointed Assistant Professor of Agriculture in 1873 and Professor of Agriculture in 1874. Professor Roberts remained in this position until his retirement in 1903, at the age of seventy years. Instruction in practical agriculture may be said to have had its real beginning with the appointment of Professor Roberts.

Professor Roberts was born in Seneca county, New York. He had only meager opportunities in the common schools of the time. He worked on the farm and as a carpenter in his home, and afterwards settled on a farm in northern Indiana. From there he moved to southeastern Iowa. In this new State he became successful as a farmer, and from his own farm he was called to the Iowa Agricultural College, first as Farm Superintendent and later as Professor of Agriculture. Although untrained in the natural sciences, he was quick to perceive their intimate relation to the development of American agriculture, and his success as a teacher was due in large measure to his ability to adapt the scientific principles discovered by others to the practical affairs of farm life.

Degrees conferred.— The announcement that the degree of Bachelor of Agriculture (B. Agr.) would be conferred on the completion of a four-years course in agriculture was first made in the University Register for 1873–1874. This action seems to have been retroactive, for at the Commencement of 1873 two graduates, Charles Y. Lacy and Loren P. Smith, received the degree of B. Agr. With the single exception of the years 1879 and 1887, there have been some students in agriculture in every graduating class. Graduates received the degree of Bachelor of Agriculture (B. Agr.) until 1885. From 1886 to 1896 the degree was Bachelor of Science in Agriculture (B. S. in Agr.); from 1897 to 1906 it was Bachelor of the Science of Agriculture (B. S. A.); in 1907 it was returned to Bachelor of Science in Agriculture and continued thus until 1912, when it was changed to Bachelor of Science (B. S.), as in the beginning. (See page 2413.)

The early course of study.— As has been stated, the distinctive feature of the regular course in agriculture as it was first outlined was training in natural science, and for several years only slight modifications were made in the course. The period from 1875 to 1890 may be regarded as a formative one, so far as instruction in agriculture is concerned. During this time only slight changes were made in the courses of instruction or in the personnel of the staff. An instructor in horticulture was added in 1874. Such modifications as were made in the course tended to strengthen the work in the various natural sciences and to direct it more particularly along agricultural lines. This was notably true of agricultural chemistry. The work in practical agriculture and horticulture was also increased in amount and considerably strengthened and systematized in character.

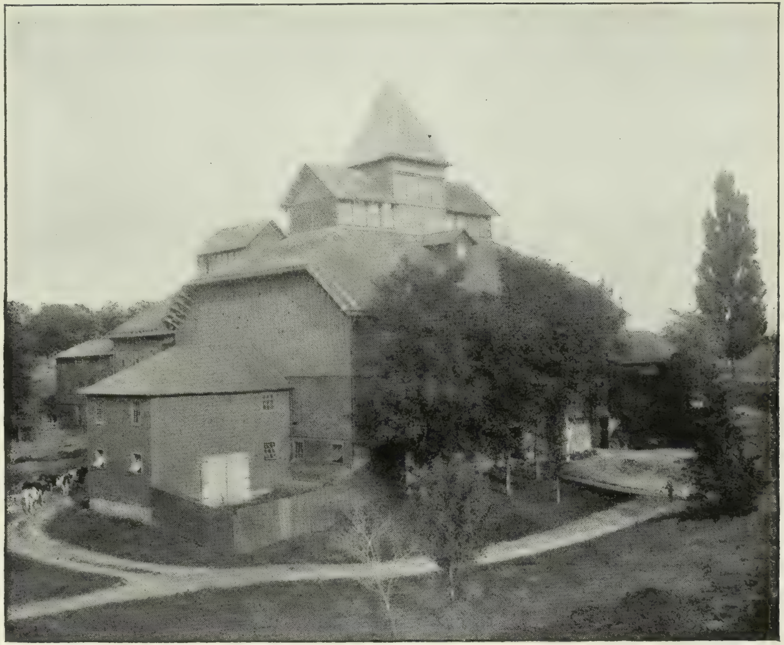
Development of the student body.— The number of students was at no time large; it fluctuated from eleven to sixty in the whole student body, with a few graduates in the various classes (see pages 2409–2410, 2413). The chief reason for the small number of students was perhaps the fact that the entrance requirements were high, for that period, and the students who spent the necessary time in preparation and then four years in the College of Agriculture naturally drifted into teaching or other professional work at the end of the course. The students graduated from the University within this period with the degree of Bachelor of Agriculture contributed very largely to the ranks of the men who achieved reputations as teachers and investigators in agriculture when the agricultural colleges began to develop rapidly throughout the country.

Special students.— An important step was taken in 1886, when it was decided to no longer limit instruction in agriculture to those who had passed the entrance examination and were pursuing the four-years course leading to a degree, but to throw the courses open to special, or short-term, students. These special students were admitted without examination and the larger part of their studies was confined strictly to the technical and practical subjects of the regular course, in accordance with the belief that farm boys might spend a year or two without special preparation in pursuing this technical work and return to their farms much better prepared for their life work. The plan from the first proved successful, although special students, from their lack of preparation, were at a disadvantage in some of the classes and subjects. The practice has been continued to the present, and during part of the time special students have composed one third to one half of the entire agricultural student body. Many young men who have received useful instruction in this way are now in the ranks of the more progressive farmers of the State and form a large, influential body of loyal Cornellians. With the great increase in regular students in recent years the proportion of special students has markedly declined, and it is now less than nine per cent of the student body.

The winter courses.—In 1892 another important step was taken in diversifying instruction in agriculture and bringing it within the reach of larger numbers of young men. This was in the establishment of the short, or winter, courses. The first Winter Course in General Agriculture began in January, 1893, and was attended by about forty-eight young men. The Winter Course in Dairy Industry was established in the following year, after the completion of the Dairy Building which was built from an appropriation by the Legislature in 1893. Students were admitted to these winter courses without examination, and the instruction was made sufficiently elementary so that young persons with little preparation could avail themselves of it; at the same time the work was made severe enough to demand effort on the part of those taking it. The success of these winter courses has been pronounced from the start, and since 1903 winter courses in Poultry Husbandry, Pomology, Floriculture, Vegetable-gardening, and Home Economics have been established. In the winter of 1912–1913, the courses were attended by five hundred and ninety-seven students.

Organization of the Experiment Station.— Investigation in agriculture, as well as instruction, early received attention on the part of the members of the agricultural faculty, and several elaborate systems of crop experimentation were devised in the early seventies. In 1879 experimental work was placed on a more systematic basis by the establishment of the Agricultural Experiment Station, governed by a Board of Control composed of the heads of the departments in the College of Agriculture. As a result of this organization three reports were published, in 1880, 1883, and 1885. While interest in the Experiment Station decreased somewhat after the publication of the third report, the organization was maintained until the establishment of the Federal Agricultural Experiment Station under the appropriation of the Hatch Act in 1887; since that time experimental work has been an important activity of the College of Agriculture. In 1888 the Federal Experiment Station was formally organized under the terms of the Hatch Act, with an income of $15,000 a year. This made it possible to strengthen the faculty along the line of experimental research, and at the same time gave greater opportunity for instruction particularly along special lines. A professor of horticulture, L. H. Bailey — the first distinctively specialized professor — was appointed. This appointment was followed by the appointment in 1891 of an assistant professor in dairy husbandry and animal industry, H. H. Wing, and from this time instruction in the various branches of agriculture began to be much more specialized.

Creation of the College of Agriculture.— In 1896 the organization of the whole University was changed and the various colleges were established on an independent basis. While no special additions were made to the faculty of the College of Agriculture at that time, the instruction assumed a more distinctive character and the number of students began to show a marked increase. From 1896 to 1903 the College developed slowly because of lack of funds and of buildings. The various departments were scattered through the different buildings of the University and in most cases were greatly hampered by lack of space. For many years previous to this time those in control had looked to the State for material aid in developing the College. This aid the State was morally obliged to give, through the con-



The old north barn

ditions of the Morrill Land Grant Act. In 1893 an appropriation of $50,000 for the erection of a Dairy Building had been made. This was the first aid that the State had given to the College of Agriculture and it was of material assistance in developing instruction in one specialized line of agriculture. Years passed, however, and no further aid was given.

In 1903 Professor I. P. Roberts, who had been Director of the College since its formal establishment in 1896, having reached the age of seventy years, retired and was made Professor Emeritus. His successor, Professor L. H. Bailey, turned his efforts at once toward gaining material support for the College from the State.

Establishment as the State College of Agriculture.— In 1904 the Legislature and the Governor established the New York State College of Agriculture at Cornell University, with an appropriation of $250,000 for the erection of the present main buildings. In 1906 the State assumed the responsibility for the maintenance of the College and passed an Administration Act.

The spirit of the work.—Within the past ten years the College of Agriculture has assumed character and has attained to a recognized standing. This has not come about solely because of growth of staff and facilities, but also because of a significant point and purpose that dominate the institution, giving the College a distinctive spirit. The spirit and the purpose, and the manner of going at the work, are the vital considerations in any educational institution. These are characteristics that are wholly impossible of measurement in statistics or of expression in print. The College has a strong community feeling with unusual harmony and cooperation of interest, its members all working together for one general end; and this end is the upbuilding of a successful, resourceful, and enduring rural civilization, of which agriculture is the basis.

H. H. WING.

ORGANIZATION OF THE STATE COLLEGE OF AGRICULTURE

Establishment.— In 1904 the Legislature of the State of New York made an appropriation of $250,000 for the erection of buildings for the College of Agriculture at Cornell University, and established the College as a state institution under the title "The New York State College of Agriculture at Cornell University." Before this time the State had established at Cornell University "The New York State Veterinary College."

In 1906 the Legislature passed an Administration Act defining the purpose and activities of the College of Agriculture as follows: "The object of the said college of agriculture shall be to improve the agricultural methods of the State; to develop the agricultural resources of the State in the production of crops of all kinds, in the rearing and breeding of live-stock, in the manufacture of dairy and other products, in determining better methods of handling and marketing such products, and in other ways; and to increase intelligence and elevate the standards of living in the rural districts. For the attainment of these objects the college is authorized to give instruction in the sciences, arts, and practices relating thereto, in such courses and in such manner as shall best serve the interests of the State; to conduct extension work in disseminating agricultural knowledge throughout the State by means of experiments and demonstrations on farms and gardens, investigations of the economic and social status of agriculture, lectures, publications of bulletins and reports, and in such other ways as may be deemed advisable in the furtherance of the aforesaid objects; to make researches in the physical, chemical, biological, and other problems of agriculture, the application of such investigations to the agriculture of New York, and the publication of the results thereof."

The funds.— The New York State College of Agriculture is supported by five classes of funds: (1) direct state appropriation, (2) certain parts of the federal funds for the maintenance of agricultural colleges, (3) annual appropriation from Cornell University, (4) income funds of the College, and (5) the Federal Experiment Station funds.

The departments.—The teaching and experimenting staff of the College of Agriculture now comprises one hundred and forty-two persons, aside from student assistants and special assistants in the winter courses. These officers are grouped in twenty-five departments, as follows: administration; agricultural chemistry; animal husbandry; botany; dairy industry; drawing; entomology, biology, and nature study; extension teaching; farm crops; farm management; farm practice; floriculture; forestry; home economics; landscape art; meteorology; plant-breeding; plant pathology; pomology; poultry husbandry; rural economy; rural engineering; rural school education; soil technology; vegetable-gardening.

The physical equipment of the New York State College of Agriculture and of the Agricultural Experiment Station is comprised in its buildings, apparatus, live-stock, and lands. All these properties are located to the eastward of the main campus of the University, but in direct connection with it. For the most part these properties are either new or recently acquired, and they are not yet fully developed.

THE FEDERAL EXPERIMENT STATION

The Cornell University Agricultural Experiment Station is established on the two Federal Experiment Station Acts, the Hatch Act, 1887, and the Adams Act, 1906. Earlier than this, however, an experiment station was established at Cornell University. The first records of this early station are as follows:

"The Cornell University Experiment Station was organized at the University, in February, 1879, for the purpose of promoting agriculture by scientific experimentation and investigation.

"At the first annual meeting of the Board of Control, held at Cornell University, June 20, 1879, the following officers were elected:

President — Professor I. P. Roberts.
Director — Professor G. C. Caldwell.
Treasurer — Professor A. N. Prentiss.
Secretary — Professor W. R. Lazenby.

"The immediate management of the affairs of the Station is vested in an Executive Committee, which consists of the four officers named above, and President G. W. Hoffman, of the Elmira Farmers' Club."

Three reports of this first Cornell Experiment Station were published, in 1879–1880, 1882–1883, and 1883–1885. The first volume comprises one hundred and thirty-three pages, devoted to experiments in dairying, economic entomology, agricultural chemistry, horticulture, and field crops. The second report contains one hundred and sixty-two pages and several plates, with accounts of experiments in field crops, cattle-feeding, agricultural chemistry, economic entomology, horticulture, and arboriculture. This report contains the study of scale insects by Comstock, which has become a standard piece of entomological literature. The third report contains thirty-nine pages, covering work on stable manures, silage, feeding, field crops, chemical analyses.

This first experiment station was never disbanded and individual workers continued their investigations, so that organization into the Cornell University Agricultural Experiment Station naturally followed the passage of the Hatch Act. This formal organization was perfected on April 30, 1888, by the appointment, by the Trustees of the University, of an Experiment Station Council, a director, a deputy director and secretary, and a treasurer. Professor I. P. Roberts was made Director; Professor H. H. Wing, Deputy Director and Secretary; and E. L. Williams, Treasurer. The first report, containing also four bulletins, covered the work of the year 1888 and was published early in 1889.

The Hatch and Adams funds are set aside wholly for experimental and research work. Only three departments receive any of the federal experiment station funds, namely, Plant-breeding, Soil Technology, and Entomology. The men who are employed on the federal funds are expected to give all their time to experimental and research work, and they receive no part of their salaries or maintenance from any other fund. They teach no undergraduate students, but they may take a limited number of postgraduates, who will become practically assistants in the investigative work. All other persons on the staff of the College of Agriculture are encouraged to conduct investigations. As the results of these investigations mature they are published as bulletins of the Experiment Station. These bulletins, however, may be published from state funds rather than from federal funds. None of the second group of men receive any part of their salaries or maintenance from the federal funds. Whatever investigations they make are contributed to the Experiment Station.

The Experiment Station does not have separate buildings and lands of its own, space for the investigations being allotted from the buildings and farms of the College of Agriculture.

Analyses of foodstuffs and fertilizers are made at the State Agricultural Experiment Station at Geneva, New York, not at the Federal Station at Ithaca.

THE COLLEGE LIBRARIES

The library facilities of the College of Agriculture include: a large collection of books and periodicals on agriculture, horticulture, forestry, entomology, and other kindred subjects, contained in the University Library and numbering fully 15,000 volumes; the Agricultural College Library (Main Building, Room 192 temporarily), with a working and reference collection of approximately 3600 bound volumes and a large number of bulletins, reports, and other pamphlets in unbound form; the Entomological Library (Main Building, Room 403, fourth floor), one of the largest and best working libraries in general entomology in the United States; and several small departmental collections for laboratory and office use. In addition to these the Agricultural College Library possesses the Craig horticultural library, gift of the widow of the late Professor John Craig, consisting of about 3000 volumes and considered to be one of the best private collections in the United States; this collection is not yet available to students because of inadequate library quarters. The Department of Animal Husbandry has a large and rapidly increasing collection of herdbooks, registers, and the like, for the use of its instructing staff and its students. Altogether, about 27,000 volumes are available for the instructing staff and the students of the College of Agriculture — including the Craig library and the duplicates carried by the various laboratories — all of which, except the Craig and laboratory collections, are regularly catalogued at the University Library and are under its general rules and supervision. The Agricultural College and Entomological libraries are practically branches of the University Library and enjoy the services of its purchasing and cataloguing departments.

All these libraries are likewise provided with the principal periodicals relating to agriculture and kindred subjects. In the University Library are to be found the back files and current numbers of the leading foreign periodicals, especially those of a purely scientific character and those used chiefly for research work. The Agricultural Library carries on its shelves nearly three hundred periodicals of various kinds for the use of students; these include the principal agricultural, horticultural, and stock-raising journals of the United States and Canada, together with many from foreign countries. The Entomological Library is supplied with the leading periodicals relating to general and economic entomology. In addition to these, many of the departments receive periodicals for the use of instructors and students, and the departments of Dairy Industry, Home Economics, and Poultry Husbandry maintain small reading rooms of their own.

Owing to restricted quarters and the necessarily limited character of its collections, the Agricultural College Library is compelled to hold all its books in reserve for reference purposes only; students are allowed to draw them for home use only when the library is closed, over night and over Sunday. In order to afford the greatest possible opportunity for using the books, the Agricultural College Library is open from a quarter of nine in the morning until ten o'clock at night every day of the week during the college year except Saturdays, when it is closed at one o'clock in the afternoon.

THE COLLEGE BUILDINGS

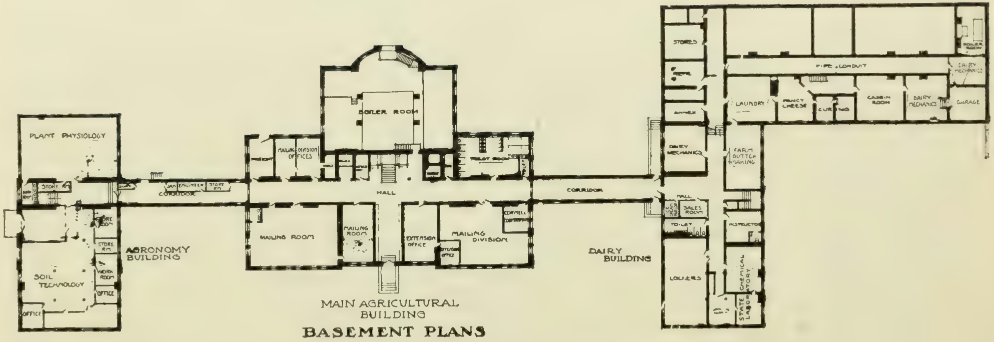
The buildings erected under the enactment of 1904 were first occupied in June, 1907. Subsequently the Legislature provided for the erection of two large barns, greenhouses, a home economics building, a poultry husbandry building, and an auditorium. Appropriations have also been made for the extension of the greenhouse range and the construction of two animal husbandry buildings, a forestry building, an agronomy building, additional barns, a rural schoolhouse, buildings for fowls in the Department of Poultry Husbandry, and a general heating-plant for the College of Agriculture — these buildings now being under construction or under plan.

The central, or original, buildings consist of a group of three — the Main, Dairy, and Agronomy buildings — and a detached building occupied by the Department of Animal Husbandry. The three buildings in the main group are connected by loggias and have a total frontage of four hundred and eighty-four feet. The Home Economics and Poultry buildings are now completed and occupied, and the Auditorium is fast nearing completion. The Forestry Building and the two buildings for Animal Husbandry are well under construction. Work will soon be started on the new Soils, or Agronomy, Building. The new horse and cattle barns are in use, and funds are available for the erection of hog and sheep barns and a tool barn and repair shop.

Other smaller buildings included in the present equipment are a frame building that temporarily houses the Department of Rural Engineering, a rural schoolhouse that serves as the headquarters for the Department of Rural School Education, an insectary, a biological station in the marsh at the south end of Cayuga Lake, a fish-breeding house in Cascadilla Creek, a seed storage house, and small buildings on the farms.

With the various farms that now constitute the college domain, there have been acquired a number of farmhouses that are used as laborers' cottages; some ten families of the men employed on the college farms are housed in these cottages. In order to provide suitable accommodations for unmarried laborers, a house has been rented in Forest Home and is being conducted as a boarding house.

Agricultural Chemistry.— The instruction in agricultural chemistry is given in Morse Hall. Here ample facilities are provided for laboratory work,



Central, or main, group, basement plans which is made an important part of the instruction. The laboratories are well lighted and are provided with gas, electric light, distilled water, and compressed air. Each student is provided with complete apparatus for quantitative analysis. The work is arranged so as to familiarize the student with the composition and properties of the more important agricultural chemicals. For the advanced courses there is a special laboratory accommodating twenty-four students. The lecture rooms are provided with electric projection lanterns for illustrating the lectures, and have large, well-equipped lecture tables. There are also a chemical museum and a reading room.

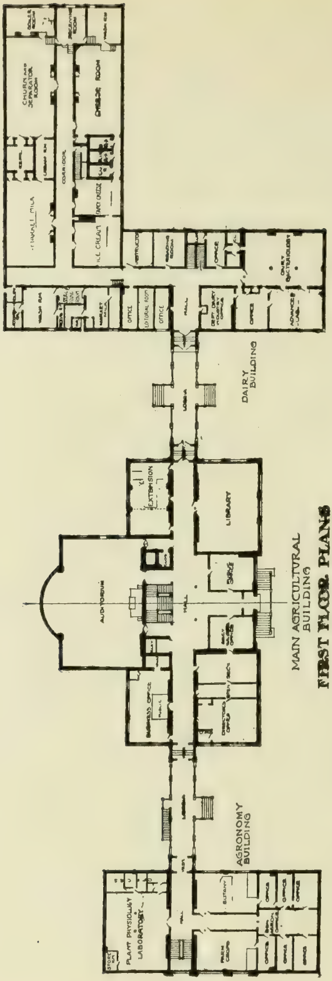
MAIN BUILDING

The basement.—The Main, or Administration, Building, central in the original group of three, has in the basement mailing and storage rooms for the publications of the College, the office of the Cornell Countryman, an extension office, and a large lavatory with baths. A completely inclosed passageway leads to the basement of the Dairy Building on the east and to the old Agronomy Building on the west.

The first floor contains, at the west of the main entrance, the offices of administration, including the offices of the Director and of the Secretary, and the business office. At the east are offices for extension teaching, and the college library (for description of library see page 2298). At the north, between these two groups of rooms, is the assembly hall, seating about six hundred persons.

The second floor is occupied by the departments of Pomology and Floriculture, with lecture rooms, laboratory, and offices for the staff. Cases in the hall are filled with pomological specimens. Here are exhibited also samples of a number of fruit by-products, fruit varieties, pruning tools, spray materials, and other appliances. Near the west end of the hall is found the Morris collection of edible nuts of the world, which contains about two hundred varieties; this is one of the best collections of its kind. A large herbarium of cultivated plants, housed in room 232, is available for advanced study. The equipment for the teaching of floriculture includes about one thousand lantern slides and several hundred negatives of specimen plants illustrating garden operations. The horticultural library of the late Professor John Craig, containing about three thousand volumes, is to be found on this floor. On this floor is provided also a women's rest room and lavatory.

Third and fourth floors.— The Department of Entomology, Biology, and Nature Study occupies all of the third and most of the fourth floor of the Main Building. The laboratories are well equipped for all phases of entomological study. There is a good supply of microscopes and accessories, including equipment for photomicrographic work. In addition there is a very full outfit for insect photography. Ample facilities, such as microtomes, paraffin ovens, and reagents, are provided for work in insect morphology and embryology, and an extensive collection of prepared slides is at the disposal of students. The insect collections, developed as an adjunct to the work of



Central, or main, group, first floor plans instruction, are especially rich in biological and illustrative material. In addition to many exotic species, these collections contain specimens of a large number of the more common species of the United States. These have been determined by specialists and are accessible for comparison. The lecture room is provided with a synoptic collection of insects, sets of the Leuckart and the Pfurtscheller diagrams, models, projection lanterns, and complete means for the projection of microscopic objects. Adjacent to the laboratories is an insectary, which, together with the insectary of the Agricultural Experiment Station, affords to advanced students exceptional opportunities for special investigation in life histories of insects and for experiments in applied entomology. For study of life histories, biology, and economic importance of aquatic forms unrivalled facilities are afforded by the field laboratory, located in the midst of the Renwick marshes and fully provided with breeding cages, running water, and aquaria, and by a hatching station on the university grounds in the gorge of Cascadilla Creek.

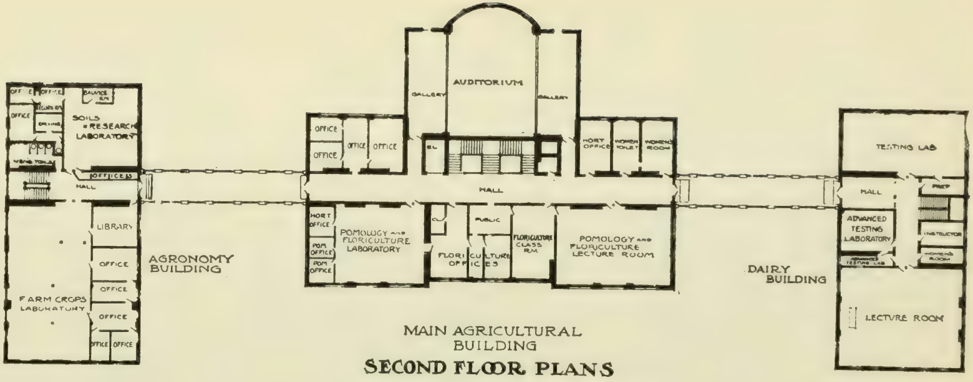
The Department of Meteorology also is located on the fourth floor of the Main Building, and is maintained in cooperation with the United States Weather Bureau. This arrangement affords an excellent opportunity for students to acquaint themselves with the practical application of the science of meteorology to weather-forecasting and to the study of local and general climatology in its relations with agriculture. The observatory is equipped with a full set of meteorological instruments, from which continuous observations are made. Reports are received by telegraph from about seventy-five weather stations in the United States; from these reports a daily weather map is made and forecasts are prepared. The department library, which in addition to general works on meteorology contains many publications bearing on the climate of various parts of the United States and of many foreign countries, is open to students.

The view from the roof of the Main Building, which may be reached from the fourth floor, is the best to be found anywhere on the campus. The view is unobstructed for many miles in all directions. On a clear day the visitor is amply repaid for the climb.

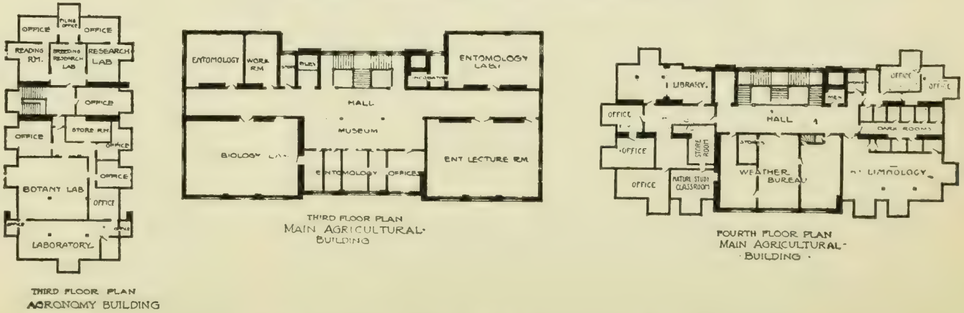
AGRONOMY BUILDING

West of the Main Building and connected with it by passageways on three floors is the original Agronomy Building.

The basement.— In the south basement of this building is the teaching laboratory for soil technology. This laboratory is equipped to accommodate one hundred and eighty students. The equipment includes apparatus for the study of the physical constitution of the soil; its capacity for retention and movement of water; its relation to the circulation of air, to heat, and to amount and effect of organic matter; and other important physical and chemical relations. Each student has the use of a desk and a locker containing a stock equipment, and of balances, microscopes, thermometers, mechanical analysis outfits, and other apparatus. Large quantities of typical New York



Central, or main, group, second floor plans



Central, or main, group, third and fourth floor plans soil are available for study, and in addition there is a collection of samples of important type soils from all parts of the United States. The study of the soils of the United States may be supplemented by detailed maps of all areas surveyed to date. All necessary equipment for the preparation of soil maps is provided to supplement the work in soil survey. A collection of soil-working implements is available for study with reference to their efficiency of operation in soils of different characters and conditions. In the north basement is one of the laboratories of plant physiology.

On the first floor are offices for the departments of Soil Technology, Botany, Farm Practice, and Farm Crops, a small classroom, and laboratories for the work in botany and plant physiology. The Department of Botany, which includes the work in plant physiology, has laboratories also on the third floor of this building and in the north basement. These laboratories are well equipped for instruction and research. The facilities include microscopes, microtomes, incubators, ovens, sterilizers, and other special physiological and bacteriological apparatus; precision instruments for the measurement of environmental conditions; chemical tables, titration stands, nitrogen still, balances, glassware, and other materials required in that part of the work dealing with biochemistry and fermentation.

On the second floor, at the right of the stairway is the large farm-crops laboratory, with additional offices for the staff. The laboratory is equipped with specially designed desks for seventy-two students. These desks are provided with gas and water and ample locker space. At the left of the stairway is the research laboratory in soil technology, which is maintained as part of the Experiment Station. It is fully equipped for the chemical and bacteriological investigation of soil problems. Accommodations are provided for a few graduate students who are specializing in soil studies.

On the third floor, at the right of the stairway is the laboratory for botany, already mentioned. At the left are the offices and laboratory of the Department of Plant-breeding. The experimental laboratory is well supplied with suitable microscopes, microtomes, paraffin ovens, and the like, for use in histological investigations; it has also a full photographic outfit, and calculating machines for the statistical study of variations. An excellent library, dealing with plant-breeding and experimental evolution, and an extensive card catalogue of plant-breeding literature, form a part of the equipment. The private libraries of members of the staff, containing many valuable books and pamphlets, are placed at the disposal of graduate students. An herbarium of variations of plants is in process of formation. [The department is soon to remove to the new Forestry Building.]

DAIRY BUILDING

East of the Main Building, and connected with it by passageways on three floors as is the Agronomy Building, is the Dairy Building, the home of the Department of Dairy Industry. The building is in two sections. The larger section, fifty by one hundred feet in extent and three stories high, contains

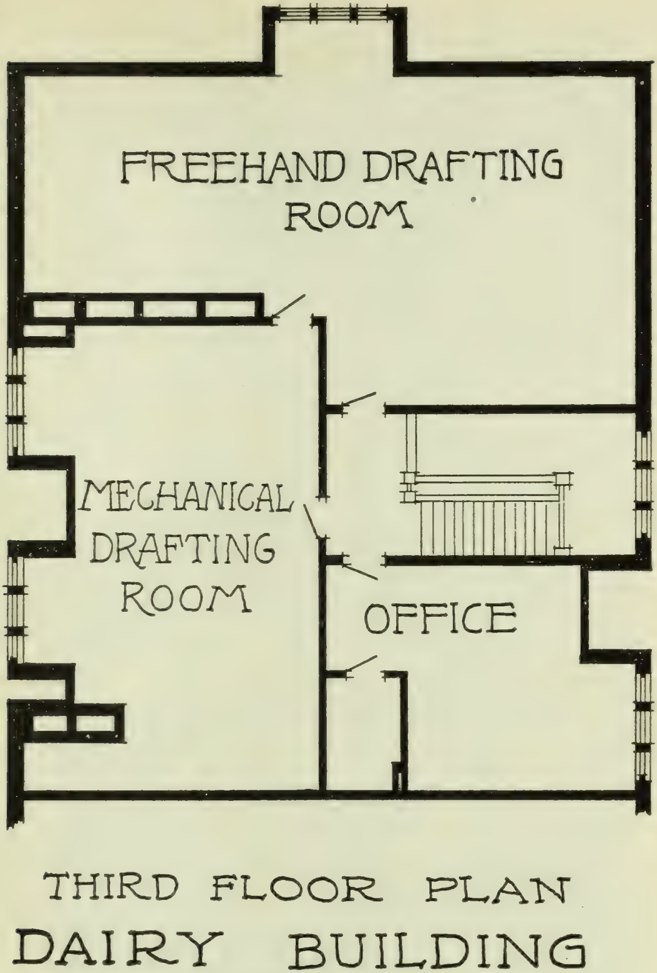
in the basement locker rooms and lavatory with bath, an office and a laboratory for a state dairy chemist, a room for dairy bacteriology, a farm dairy room equipped with hand-power separators, churns, and other appliances, and rooms for instruction in dairy mechanics. Here is also the salesroom for the department.

On the first floor are the general offices of the department, two large laboratories for dairy bacteriology, a small museum and study room, and the editorial office of the College. The laboratories for bacteriology are provided with individual desks and lockers for students, full equipment for making media, hot air and steam sterilizers, incubators for maintaining constant temperatures, a specially insulated incubator room, high-speed centrifuges for determining sediment and bacteria content of milk, high-power microscopes, and all glassware necessary for bacteriological work.

On the second floor are the large lecture room seating two hundred persons, a preparation room, the milk-testing laboratory, advanced testing laboratories, and a lavatory. The testing laboratory is equipped with lockers for students, the leading styles of turbine and hand centrifugal Babcock testers, one Russian Babcock tester, one Gerber tester, casein testers, moisture and acid-testing apparatus, lactometers, and all necessary glassware.

The third floor is fitted for the teaching of the courses in drawing that are required in the various courses in the College. Skylights in the roof furnish abundant light. There are two drafting rooms. The one for mechanical drawing is equipped with thirty specially designed desks, each containing the materials of two students, thus providing accommodations for a total of sixty students. For instruction in mechanical drawing there is a small collection of simple machine parts, wooden models, and demonstration apparatus. The free-hand drawing room is equipped with thirty-five Cleaves drawing desks. For study there are provided a number of casts, copies of classic sculpture, artificial plant forms, and a collection of insects, shells, skulls, and stuffed birds and animals, together with a series of reproductions, in color and in black and white, of good examples of graphic art; the aim being to develop the student's appreciation of art as well as to teach him how to draw.

The manufacturing wing.— Connected with this building is the extension, sixty by one hundred and sixty feet in extent and one story high, with attic and basement, containing the manufacturing rooms. Entering the factory wing from the main Dairy Building, the rooms for market milk are found on the left. These consist of a series of rooms, including receiving room, bottling room, washroom, special refrigerator, and sterilizer. In the arrangement of these rooms the principles governing the proper management of a commercial sanitary milk plant have been considered. The equipment includes a rotary bottle-washer, a rinser, several styles of milk coolers, and bottle-filling apparatus. The College operates a market-milk route for the disposal of milk produced by the college herd, and all records are kept in the same manner as in any commercial dairy.



Dairy building, third floor plan

On the right is the room for the making of ice cream, well equipped with power machines and necessary appliances; adjoining this room on the east is the room devoted to the making of fancy cheeses. On the same side of the long hall and adjoining the fancy-cheese room on the east are the rooms for the making of cheddar cheese. The cheese-factory room is equipped with vats for making cheese in small or large quantities, one horizontal continuous pressure press, one upright press, hoops for making cheese in four sizes, rennet tests, acid tests, curd mills, and other small apparatus. Four insulated curing rooms adjoin the manufacturing room. At the extreme eastern end of the building are the milk-receiving room and the can-washing room, convenient both to the creamery and to the cheese rooms. These are provided with scales, a composite sample outfit, and a power can-washer and -rinser. Adjoining the milk-receiving room on the north is a boiler room with thirty-horse-power boiler, engine, and necessary pumps.

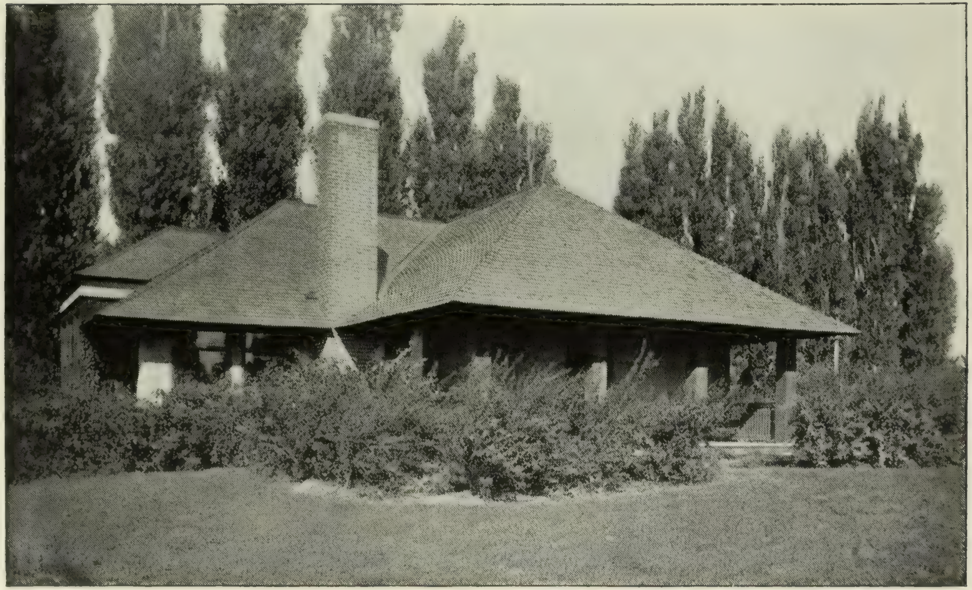
Returning along the main hall, the visitor finds on the north side the rooms for teaching creamery methods of butter-making. There is first a large separator-and-churn room provided with several types of power separators, milk-heaters, cream-ripeners, a starter can, pasteurizers, and churns. Beyond are special rooms for ripening cream and for holding butter in cold storage. Finally, at the end of the hall, just opposite the ice-cream room, is the market-milk room, provided with coolers, bottle-washers, bottle-fillers, and all necessary apparatus for teaching the handling of market milk.

In the basement under the ice-cream room is a fully equipped steam laundry.

Extent of dairy business.— In the year 1912–1913 the total number of regular students taking work in the Department of Dairy Industry was 680. In addition, 86 students took the twelve-weeks Winter Course in Dairy Industry, and 101 students in the Winter Course in General Agriculture took dairy work in the department. In order to give practical instruction to this number of students, it is necessary to handle large amounts of the different dairy products. During the past fiscal year the products manufactured and handled by the Department of Dairy Industry were as follows:

Butter	322,740 pounds
Cheddar cheese	37,319 pounds
Fancy cheeses (cottage, club, neufchatel, pimento, cream, olive cream)	17,231 pounds
Market milk	156,220 quarts
Ice cream	3,198 gallons

The supply of milk and cream for this work is received from the college herd and from five receiving stations operated by the department. These are located in a northerly direction from Ithaca, at West Groton, Howland, Sage, North Lansing, and Lansingville. These stations are not operated for purposes of financial gain, but solely with a view of providing an adequate milk supply. The amount of butter-fat is made the basis of payment for this milk. During the winter the department buys cream from several other creameries also. In winter about fifteen thousand pounds of milk



The Rural School building, home of the Cornell Rural School Leaflet

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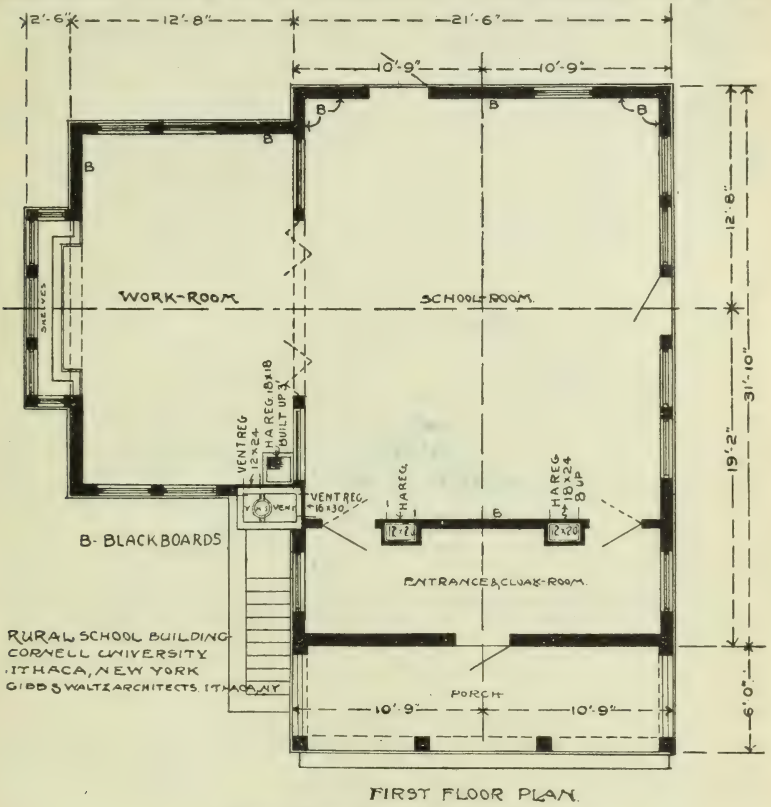
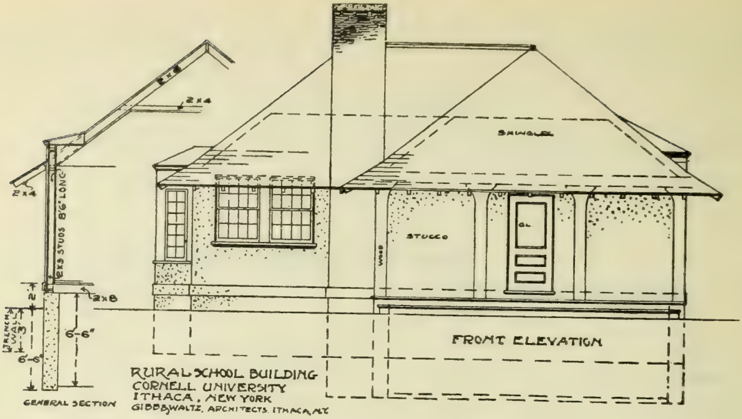
are handled daily, and in summer the milk received at the Dairy Building and the cream received from five skimming stations represent about thirty thousand pounds of milk daily.

SCHOOLHOUSE

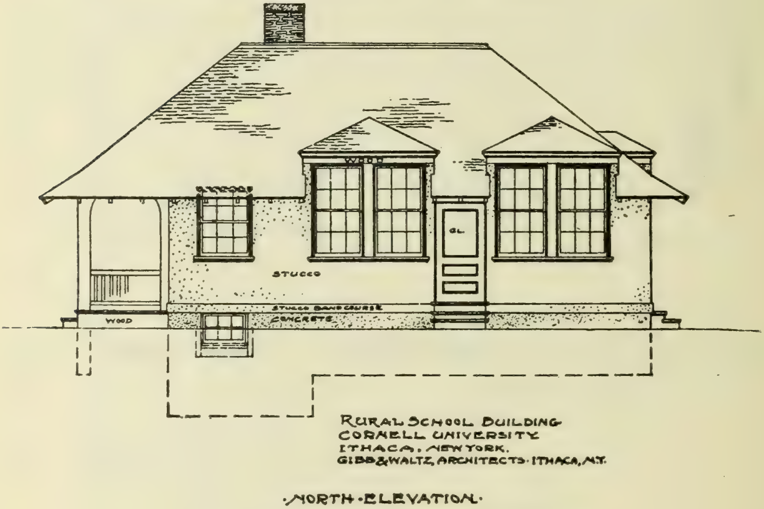
West of the Agronomy Building and across the highway is the small rural schoolhouse, which is used as headquarters for the extension work in rural



Rural School building, floor plan



Rural School building, front elevation



Rural School building, north elevation school education. The building demonstrates a one-teacher school having two rooms — a main classroom, and a workroom in which the children can conduct experiments along the lines of natural history, agriculture, and domestic science. The building is so planned that the teacher, while conducting classes in the main room, can see the children in the workroom.

An equipment is being accumulated that will be suggestive to all rural teachers: pictures for the walls, books graded according to the ages of the pupils, aquaria, terraria, materials for teaching insect, bird, plant, and earth-science subjects, materials suitable for exhibits, and a simple domestic-science equipment.

The building is used as the editorial office for the Cornell Rural School Leaflet, a publication which provides subject matter for the work of each year in nature study and elementary agriculture, as outlined by the New York State Syllabus, and which offers suggestive lessons in domestic science.

Connected with the school building is a school garden, which is presented as a concrete demonstration of a working laboratory for rural schools.

AUDITORIUM

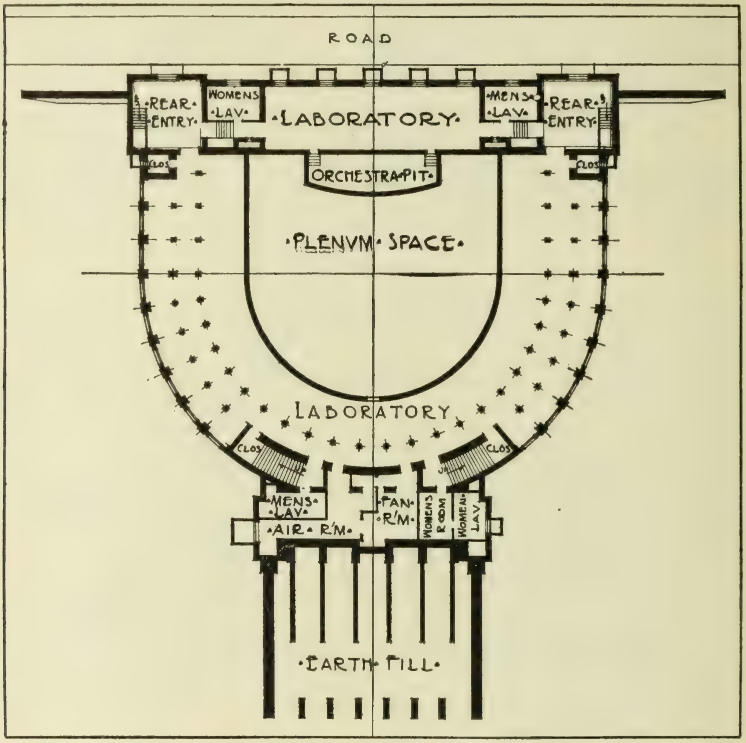
Northwest of the main group of buildings of the College of Agriculture is the new Auditorium. It is an imposing structure of brick and concrete construction, situated on a low terrace at the head of Garden Avenue, the main thoroughfare leading to the College of Agriculture. The building is of classic design and is semi-circular in shape. The approach is by a flight of wide steps to the spacious vestibule, at the entrance into which are massive stone columns. These columns and the other stonework used in the construction of the building are of Indiana limestone. Each column is a monolith nineteen and one half feet high by two feet and three inches in diameter. Similar columns are spaced around the sides of the building, forming a loggia from which wide doors lead to the corridor surrounding the auditorium chamber.

The auditorium has a seating capacity of approximately two thousand persons, of which number the balcony seats six hundred and fifty.

The proscenium arch is one of the largest in the country, the opening being sixty-seven feet wide. The stage, with a height of thirty feet, lends itself most favorably to the accommodation of the organ which is to be placed here through the courtesy of Mr. Carnegie.

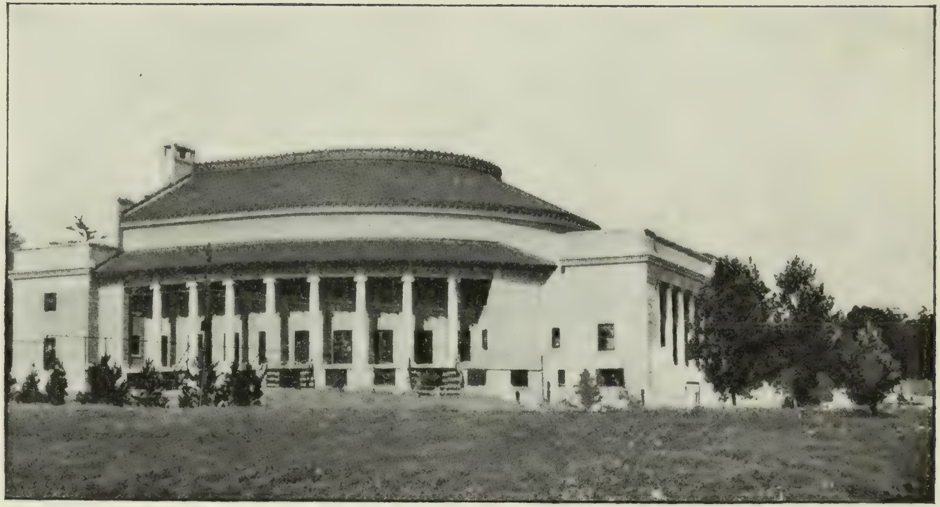
Beneath the stage is a large, well-lighted laboratory room, and at either side of the stage, on both the main and balcony floors, are additional rooms for offices and for laboratory work.

During the year 1913–1914 the Department of Plant Pathology is to be housed in the east and west basements, the west basement being used for undergraduate classes and the east basement for offices and for postgraduate work. The equipment in plant pathology includes furniture especially built for the work of the department, a set of microscopes, microtomes, sterilizers, electric incubators, and the like, for purposes of teaching and investigation. The equipment includes also a rapidly growing pathological herbarium, numerous photographs, and a departmental library. It is expected that within the coming year the department will be housed in a separate building affording more ample accommodations.



The Auditorium, basement plan

The Department of Rural Economy is to occupy the offices on both floors in the northwest corner of the building. In this department the essentials of an equipment are provided in the way of census volumes, state and national maps and charts, and adding and calculating machines. The University



The Auditorium

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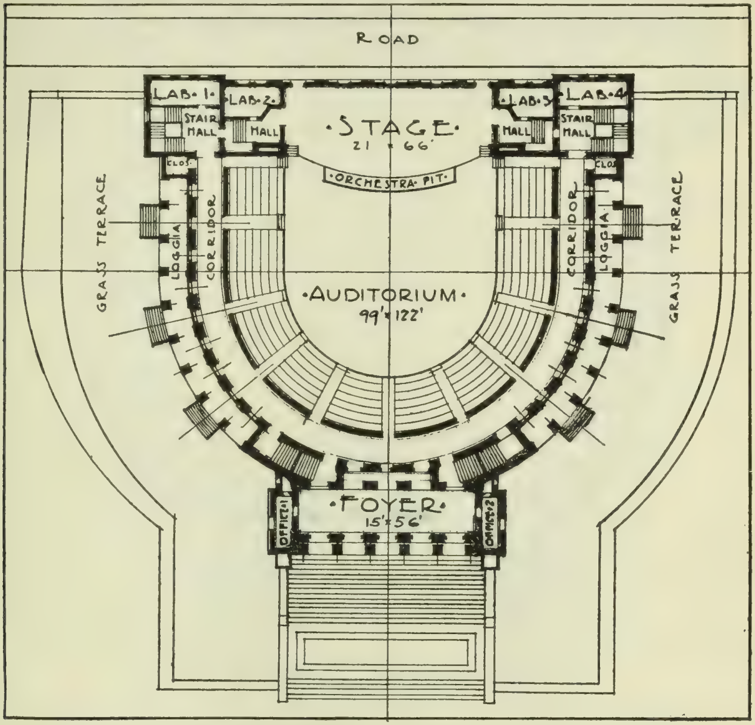
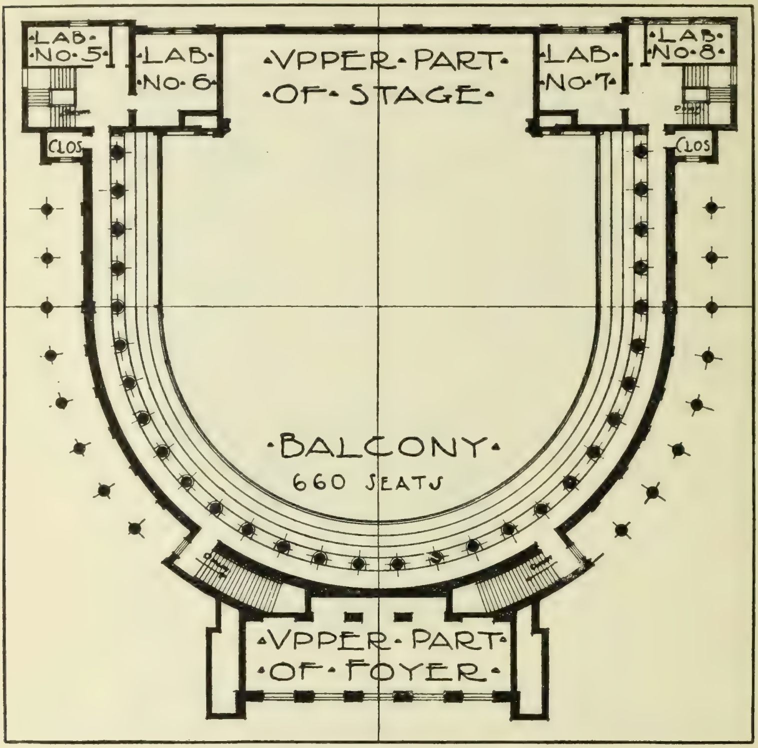
Library houses a representative collection of books and pamphlets on the general economic and social conditions of agriculture the world over. The collection is especially rich in the history of agricultural changes and conditions in western Europe. A beginning has been made toward a collection of lantern slides illustrative of the history of agriculture and the social condition of the rural community.

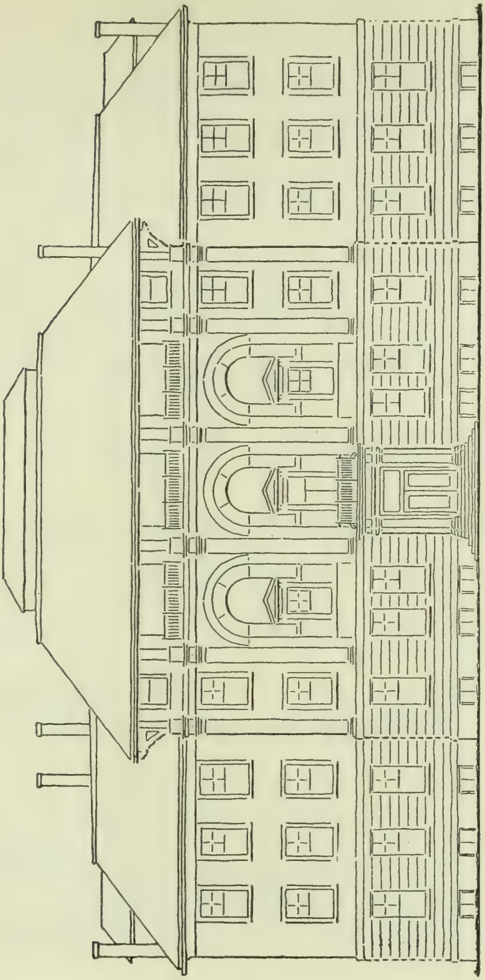


The Auditorium, main floor plan

The Department of Vegetable-gardening occupies the offices on both floors in the northeast corner of the Auditorium, and utilizes the large room beneath the stage for class purposes. The collections of preserved specimens, herbarium material, and slides and photographs are well established and are being rapidly built up as an aid to instruction.



The Auditorium, balcony plan

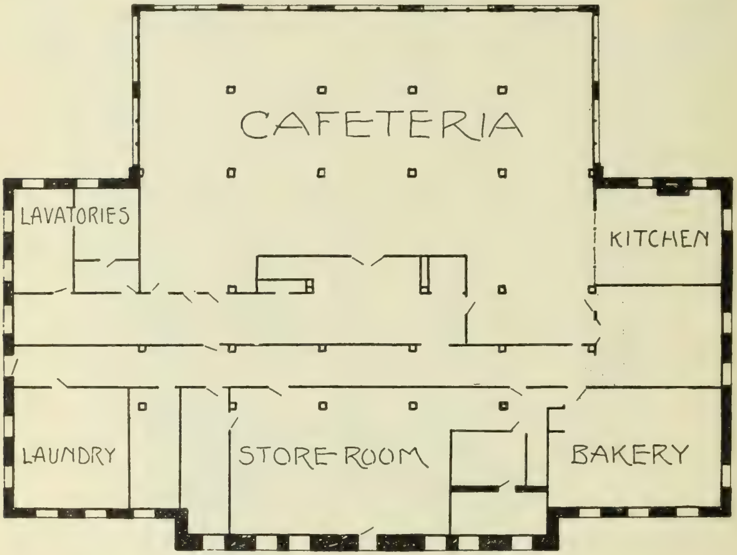


Home Economics building

HOME ECONOMICS BUILDING

The new Home Economics Building stands directly east of the new Auditorium. It was erected on an appropriation of $154,000 provided by the State Legislature in 1910. The building was first occupied in February, 1913.

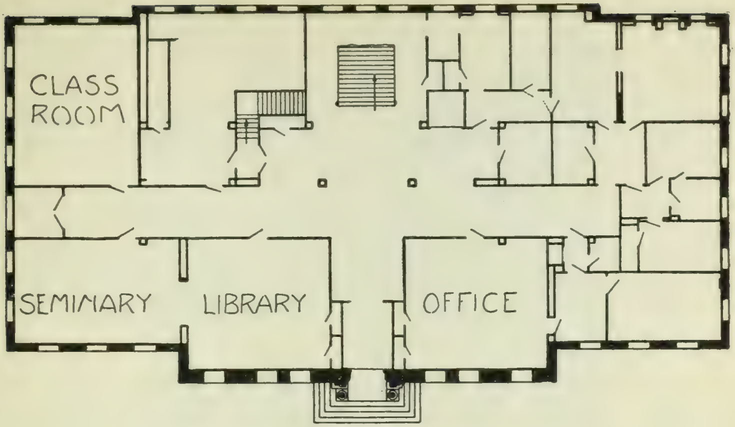
In the basement of the building is a cafeteria, with kitchens and laundry. The cafeteria serves as a practical laboratory in institutional management.



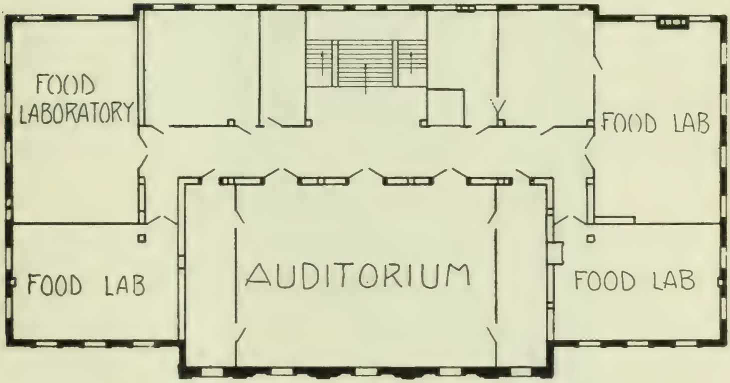
Home Economics building, basement plan

On the first floor are offices, a library, classrooms, and a model apartment in which students in turn have practice in family housekeeping.

On the second floor is the assembly room, seating three hundred and fifty persons. In this room are held the large classes of the department, public lectures, and social functions. Opposite the assembly room is a large family kitchen and a dining room for serving. At both ends of the hall are food laboratories, thoroughly equipped for use in teaching the principles of food preparation and nutrition.



Home Economics building, first floor plan



Home Economics building, second floor plan

The third floor is devoted to sewing, dressmaking, and millinery laboratories. At the east end of the hall on this floor are a chemical laboratory, not yet equipped, and offices that are given over to the temporary use of the Department of Forestry.

On the fourth floor house-planning, -decorating, and -furnishing are taught. For this purpose a large drafting room, well lighted by means of a skylight, is provided. In front of the drafting room is a loggia. At the west end of this floor is the laboratory for household management; at the east end is the recreation room for students.

The department has a good equipment of reference books, lantern slides, illustrative material, and labor-saving devices.

The Home Economics Lodge, west of the Home Economics Building, is a small house that has been reconstructed and redecorated, in which students of the department, together with an instructor, keep house. The principles of food preparation, household management, and house-decorating and -furnishing are taught here in a practical way.

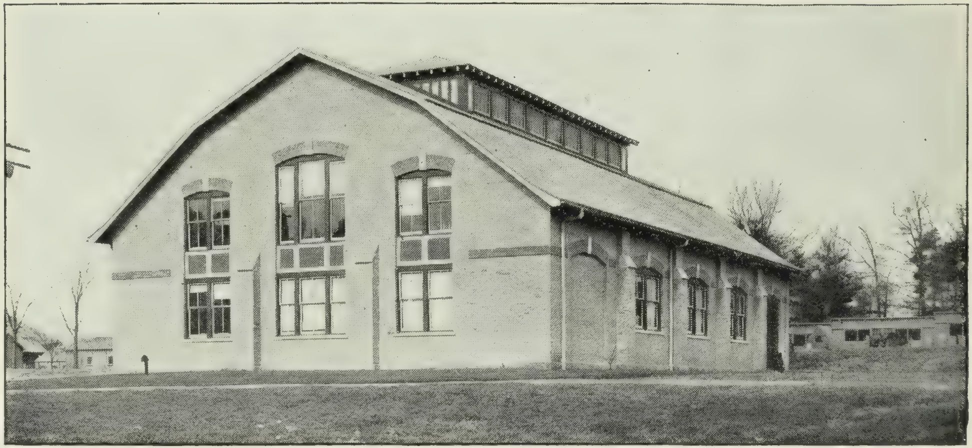
PRESENT ANIMAL HUSBANDRY BUILDING

At present the Department of Animal Husbandry is lodged in a one-and-one-half-story building situated north of the east wing of the Dairy Building. This building is ninety feet long and sixty feet wide. It contains a judging room, a classroom, a library, and the offices of the department. The judging room is sixty feet square and is equipped with many appliances to aid in a study of animals, such as double scales, skeletons, models, blackboards, and the like. The lecture room has a seating capacity of one hundred and fifty persons and is equipped with a lantern, one thousand slides, charts, models, and other apparatus. The library is thirty feet square and contains approximately fifteen hundred volumes of stud, herd, and flock books.

New buildings for the Department of Animal Husbandry (page 2333) are under construction, and when completed and ready for occupancy the present Animal Husbandry Building will become the headquarters of the Department of Farm Management.

RURAL ENGINEERING BUILDING

The Rural Engineering Building, the headquarters of the Department of Rural Engineering, stands east of the present Animal Husbandry Building. It is a temporary one-story structure, forty by ninety-six feet in size, with laboratory space forty by eighty feet and offices forty by sixteen feet. A stock room occupies one corner of the laboratory, and there are two small galleries, each six by thirty-two feet, which are used for housing additional machinery. The equipment of the department includes a small steam engine, several gasoline engines, pumps of various kinds, hydraulic rams, water-supply systems, a windmill, a grain binder, several binder attachments, plows, cultivators, and planters. The sprayograph, for testing spray nozzles, was



The present Animal Husbandry building

designed and built by the department and is used in class exercises and in research work. A recording traction dynamometer is used for testing purposes. For the work in farm engineering the department has nine farm levels, a light Y level, a fine precision dumpy level, two transits, and leveling rods, tapes, and the like. Models of septic tanks are provided for the work in sewage disposal. Two modern-type plank barn-frame models are exhibited in connection with the work in farm structures.

LANDSCAPE ART BUILDING

Northeast of the Rural Engineering Building, situated among the trees, stands the Landscape Art Building, now in process of reconstruction.

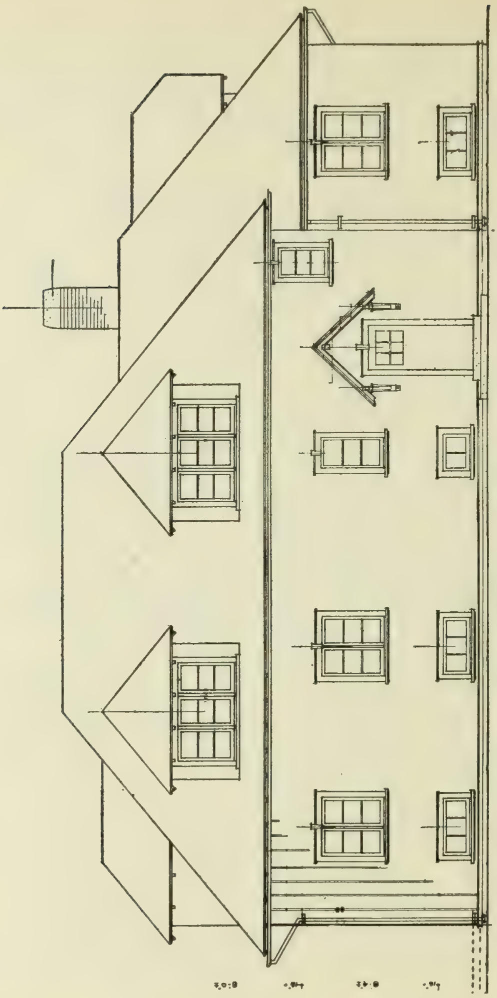
The basement.— Owing to the hillside site of the building the basement story is out of ground to its full height on the rear, or woods side. This floor will contain the departmental library, entered directly at the foot of the stairs, and an exhibition room at the north end beneath the lecture room. The departmental library, while still in its infancy, contains a considerable number of volumes on the general subject of landscape architecture and design, as well as on allied topics of architecture, engineering, planting, and the like. The exhibition room, designed primarily as the place for the hanging, judging, and final criticism of student problems in design, engineering, and planting, will be used also for occasional exhibits of the work of practicing landscape architects and for exhibitions of paintings. This room will have an important auxiliary use as the drafting room for the campus plan of the College of Agriculture, the preparation of which is in charge of the Department of Landscape Art.

Across the rear of the building at the basement grade there is to be a flagged terrace, to which access will be had through French doors from the library and the exhibition room. This terrace will occasionally be used in fine weather for out-of-door classes.

The first floor of the building, a few steps up from the entrance at grade, is to be devoted to the offices of the department and to a lecture room. The offices will be entered from the main hall directly opposite the stairs. The lecture room, at the north end of the building, will seat eighty-eight persons and will be equipped with a stereopticon lantern. This room is to be used not only for all the regular classes of the department, but also for special and general lectures and for departmental gatherings.

The entire area of **the second floor** of the building is to be devoted to the drafting room, accommodating about thirty-five students. Each student will have his allotted space at one of the drafting tables and a large drawer for the storage of material. Work in junior and senior design, in landscape engineering, and in planting design will be conducted here.

The building as it now stands is a reconstruction and slight enlargement of a building originally built by and belonging to the Department of Poultry Husbandry. The construction was undertaken in 1904 under the direction



Landscape Art building

of Professor Rice, on a site slightly southeast of the present Home Economics Building. The building was constructed for the most part by students in poultry husbandry and was built largely of material obtained from the old university filtration plant, which the students wrecked for the purpose. During the summer of 1913 the building was acquired by the Department of Landscape Art, and later was moved and reconstructed as it stands at present. Effort has been made to avoid altering materially its original appearance in accommodating it to its new use.

Equipment.—An important part of the teaching equipment of the department is its collection of lantern slides, now numbering about twenty-seven hundred and being constantly enlarged. The collection, which is illustrative primarily of the history and theory of landscape design, includes also examples of planting and of plant materials; in the latter field considerable additions are at present being made.

GLASSHOUSES AND ATTACHED LABORATORIES

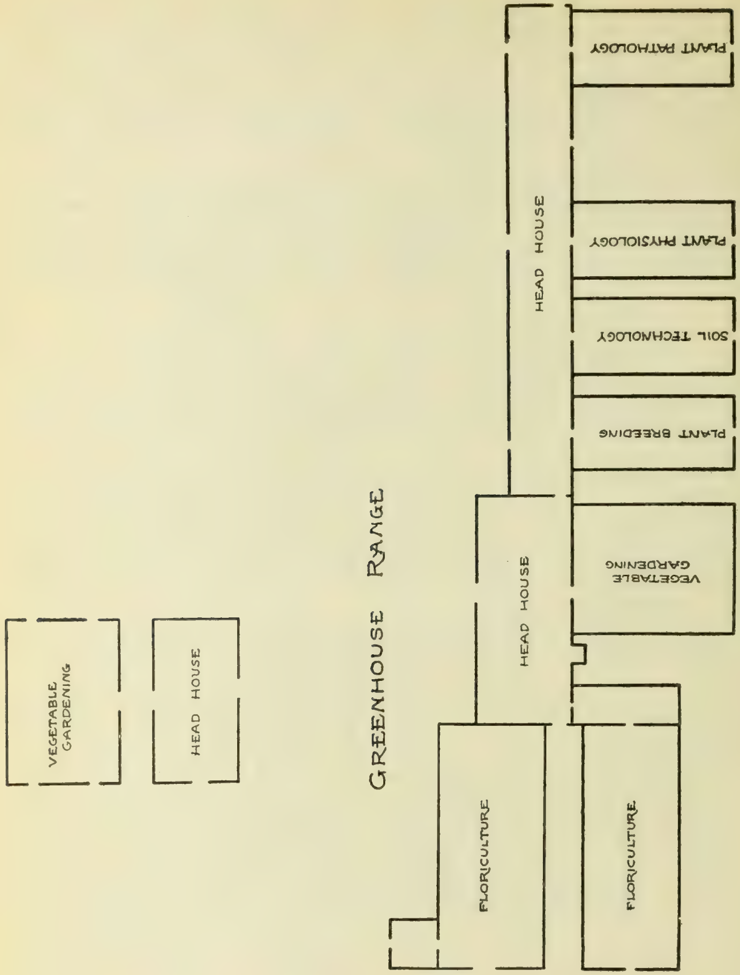
East of the Dairy Building are the glasshouses and laboratories for instructional and investigative work in floriculture, vegetable-gardening, plant-breeding, soils, and plant pathology. The present glasshouse space is assigned as follows:

A house consisting of six rooms, with a total ground space of 5261 square feet, is used by the Department of Floriculture. The work in this area is largely of an instructional nature, very little space being available for investigative work. The plants grown in these houses are chrysanthemums, carnations, orchids, palms, and other conservatory plants. Plans are under way for an additional house for roses. This will be located south of the present greenhouse.

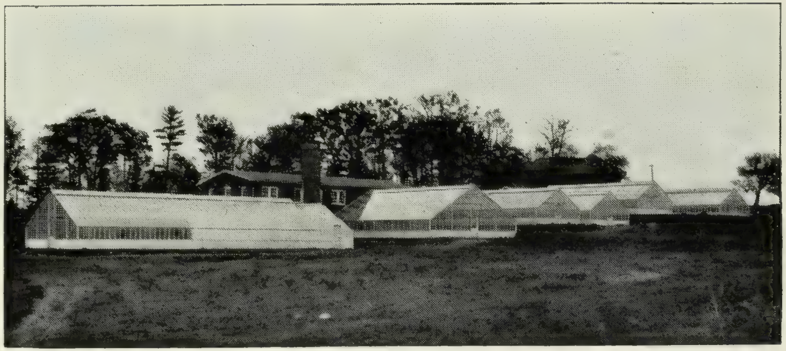
East of this house is the house assigned for instructional work in vegetable-gardening, covering approximately 2000 square feet. In this house space is assigned to individual students, who are responsible for the crops grown. North of the present head house another house for vegetable-gardening, with an attached workroom, is under construction, and other houses are to be added.

The head house is devoted to laboratories for practical work in various horticultural subjects. It is a two-story stucco building, covering 2100 square feet. In the basement are boilers for heating the range, coal-storage rooms, and space for storage of pots. The first-floor laboratory is used by the departments of Floriculture and Vegetable-gardening. The second-floor laboratory is used by the departments of Pomology and Plant-breeding.

A corridor 150 feet long runs eastward from the head house. Extending southward from this are four glasshouses, each covering approximately 1175 square feet. These are used by the departments of Plant-breeding, Soils, Plant Physiology, and Plant Pathology, respectively. North of this corridor are classrooms and workrooms for these departments, each covering an area of about 380 square feet. North of this corridor there are also lavatories.



The greenhouse range, ground plan



The greenhouse range

An old range of glasshouses stands on the knoll northeast of the new range. This consists of three houses, each covering approximately 630 square feet. A small head house is attached to this range. One of these houses is used by the Department of Grounds, another by the Department of Plant-breeding, and the third by the Department of Soil Technology.

Directly north of the east end of the glasshouse range stands the small seed house of the Department of Plant-breeding.

FILTRATION PLANT

The next building to the eastward is a red brick structure with tile roof. This is the university filtration plant.

FORESTRY BUILDING

A short distance east of the filtration plant is the new Forestry Building, in process of construction. It is being erected at a cost of $120,000, including equipment. The building is one hundred and forty-two feet long and fifty-four feet wide, and will have three floors and an attic.

On the first floor will be a large laboratory for study in wood technology, a smaller laboratory for advanced work in wood technology, and a timber-testing room. On this floor will be provided also a locker room, a freight room, a tool room, and a room for the storage of laboratory materials.

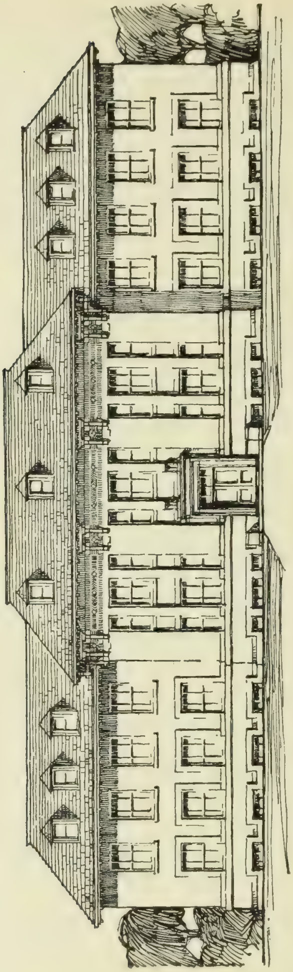
The second floor will contain a group of offices, consisting of a general office and six private offices connecting with it; a laboratory for mensuration and utilization; a lecture room, fitted with an automatic window-darkening apparatus so that lantern slides can easily be used in lectures; an instrument room; a lecture-material room; a classroom; and a reading room.

On the third floor will be a laboratory for silviculture and dendrology, a museum, a drafting room, a classroom, a seminar room, and an herbarium room. The third floor and the attic will be occupied also by the Department of Plant-breeding. On the right is a large laboratory for the use of undergraduate students. On the left are a smaller laboratory used for research, and a classroom. Between the two laboratories, on the north side of the building, is a group of offices, and there are two offices on the south side of the building to be occupied by heads of the department.

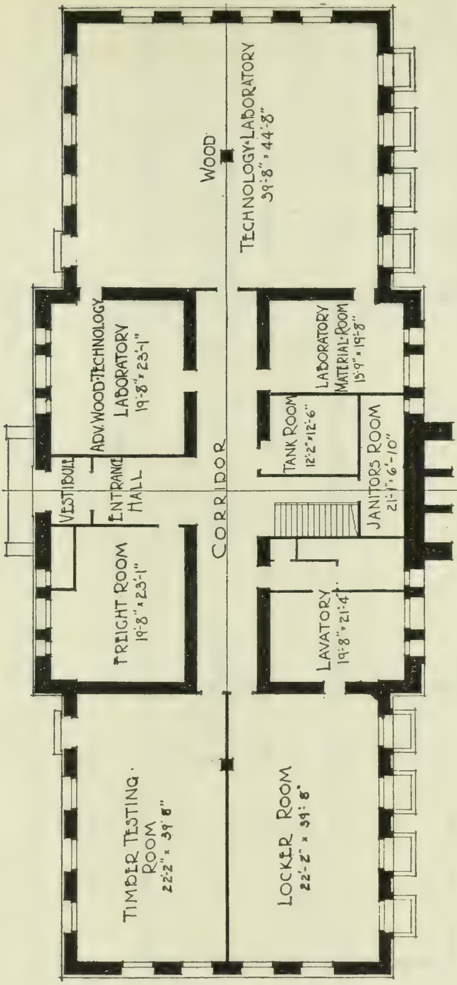
There is considerable space **in the attic,** where camera and dark rooms will be provided and also laboratory space for advanced students. A room will also be fitted up for the forestry club. The west end of the attic is occupied by the Department of Plant-breeding. The extreme western laboratory is for graduate students. On the south side is a photographic and dark room, and on the north side is a room for holding seminars and for the plant-breeding club.

There is an ample collection of forestry instruments and lantern slides.

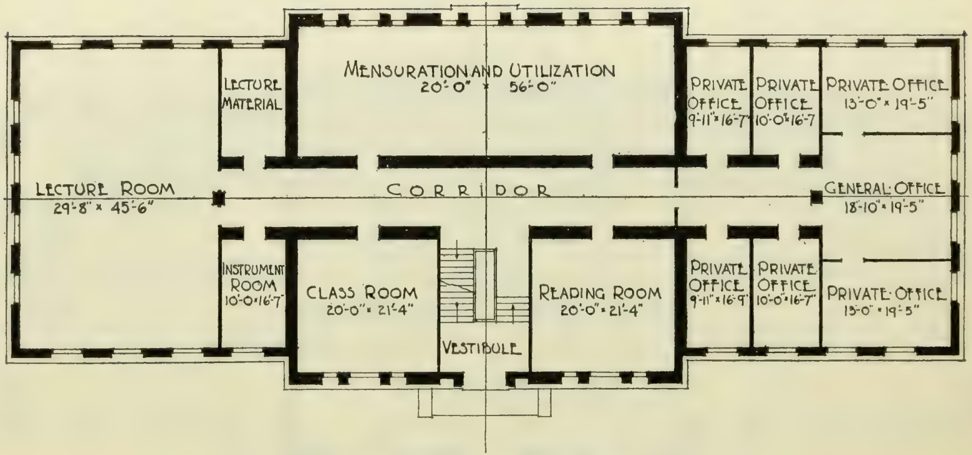
A forestry library of over twelve hundred bound volumes, including extensive files of forestry periodicals, is housed in the University Library.



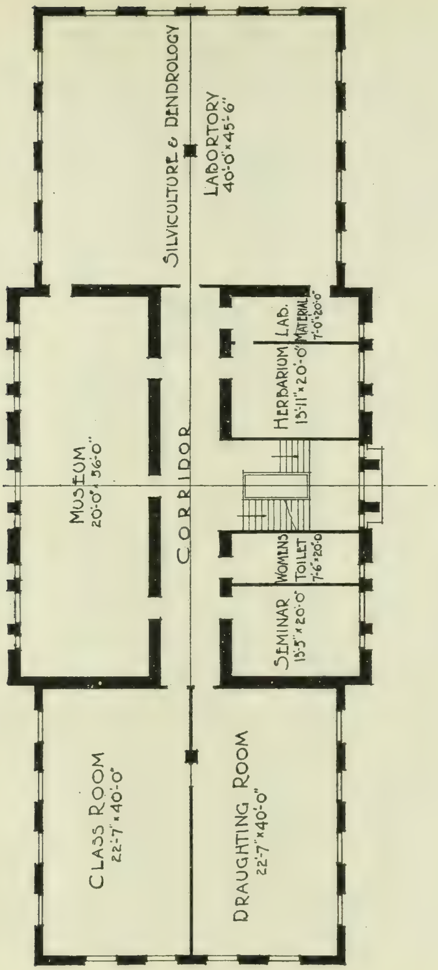
The Forestry building



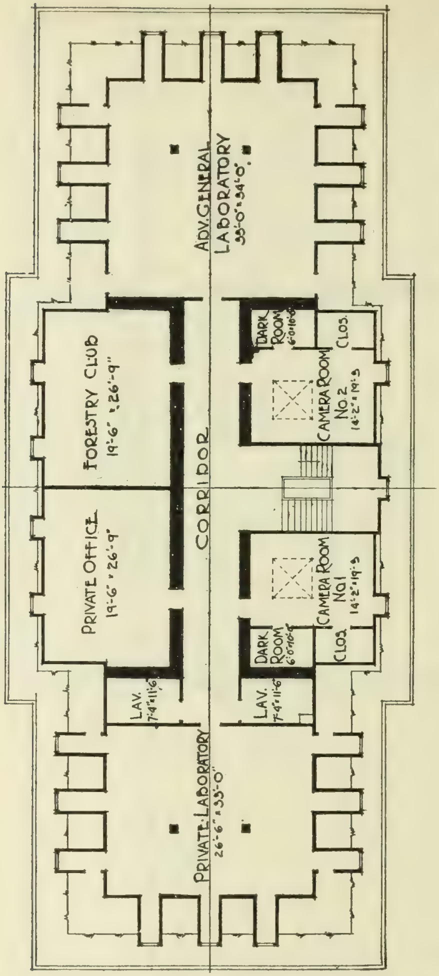
Forestry building, basement floor plan



Forestry building, first floor plan



Forestry building, second floor plan



Forestry building, third floor plan

Historical.— It is of interest to know that the teaching of professional forestry in American universities had its beginning at Cornell, where the first College of Forestry in this country was established by the Legislature of the State of New York in 1898. After a period of efficient service, instruction was suspended in the College on June 17, 1903, and from that time until the fall of 1911 no courses were offered. During the year 1910–1911 a Department of Forestry was established in the New York State College of Agriculture at Cornell University, and in December, 1910, a professor of forestry was appointed. This professor assumed his duties at the College in June, 1911, and gave regular instruction to students in general agriculture during the next college year. Detailed plans for giving a professional course in forestry were completed in the fall of 1910. This professional course was not finally opened to students until the fall of 1912, since during the college year 1911–1912 the department was not yet fully equipped to offer all the professional forestry work.

HEATING PLANT

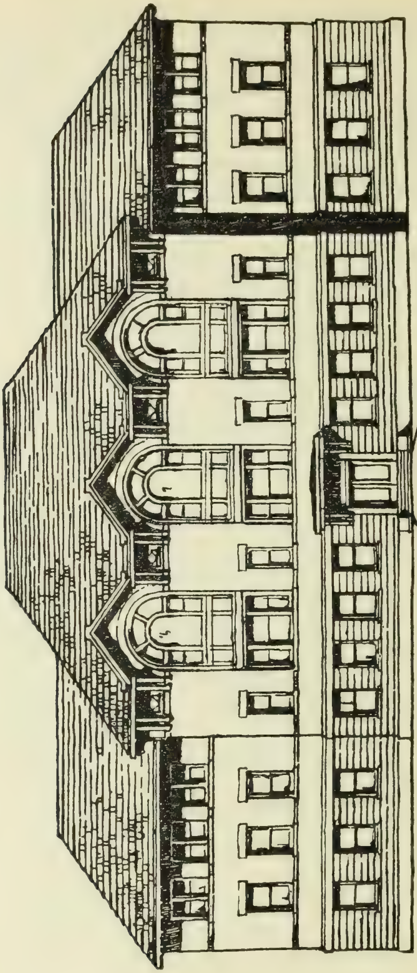
Under the hill, and a short distance northeast of the Forestry Building, is the central heating plant for the College of Agriculture. Steam pipes connecting with all the buildings of the College will be run through underground concrete tunnels. The plant is nearing completion and should be fully ready for service during the next college year.

POULTRY HUSBANDRY BUILDING

The new Poultry Husbandry Building, erected at a cost of $90,000 and first occupied in February, 1913, faces the main highway some distance east of the greenhouses. It is one hundred and thirty-two feet by forty-eight feet in size, and consists of three stories, an attic, and a basement. The main entrance is on the south side of the building and connects with a corridor that extends through the center of the building from east to west.

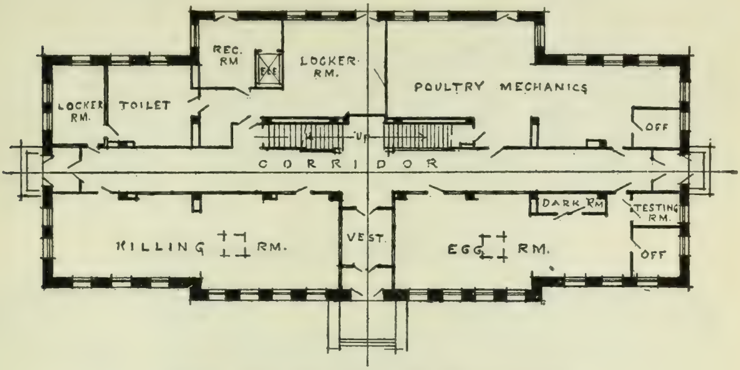
The first floor is given over exclusively to laboratory, or handicraft practice, rooms. The first room (100) at the right of the main entrance is for cleaning, testing, grading, and packing eggs; the room (175) at the left is for killing, picking, and packing poultry. Freight elevators are installed in each of these rooms, for carrying poultry and eggs to and from the cold-storage plant in the basement. Across the main corridor at the right is the mechanics laboratory (125). This room contains various kinds of machinery, such as feed-grinders, feed-mixers, a buzz saw, bone-cutters, a sand blast, and a large assortment of carpentry tools. The machinery is operated by a gasoline engine or a twenty-horse-power electric motor.

Across the main corridor at the left is the entrance into the locker rooms and the lavatories (153), where there are locker facilities for about two hundred and fifty students. In this part of the building is also the freight entrance, and near it is an elevator operating from the basement to the top



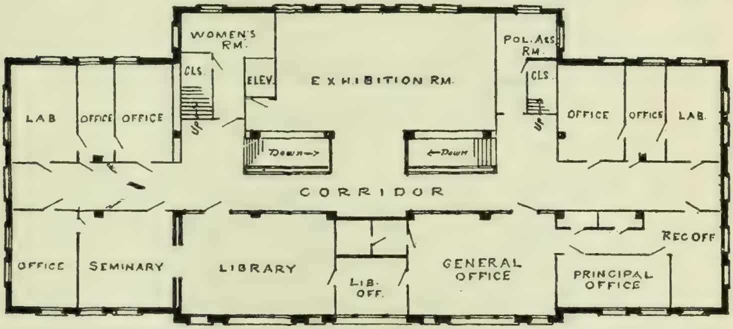
Poultry Husbandry building

floor. The room for extension work (154) is located at the extreme west end of the corridor, on the north side of the building.



Poultry Husbandry building, first floor plan

In the main corridor opposite the entrance, an electrically illuminated lantern-slide display is staged. Above this is placed a bulletin board showing

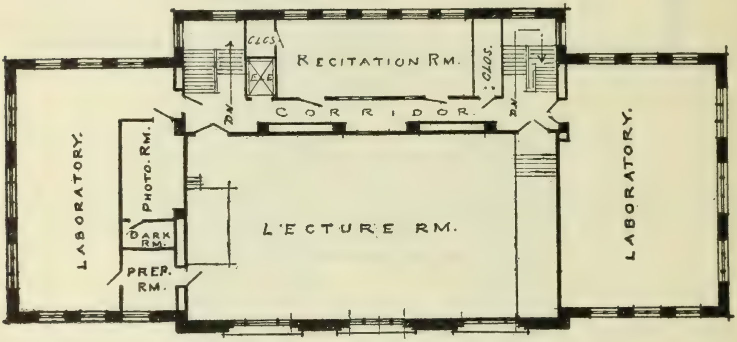


Poultry Husbandry building, second floor plan

the fluctuating market quotations on poultry products. A sales window for the retail distribution of poultry products is near the main entrance.

The second floor of the building is reached by two staircases. This floor is devoted to private offices, laboratories, an exhibition room, the poultry library, the poultry seminar room, and general offices (200 and 205). On this floor are also a women's rest room (250) and the office of the Cornell University Poultry Association (228).

The Department of Farm Management is temporarily housed on the second floor. This department occupies a set of offices at the west end of the building, and has the use of the large lecture room on the third floor and two laboratory rooms in the building. In the near future the old Animal Husbandry Building is to be remodeled for the Department of Farm Management; an appropriation of $10,000 was made by the Legislature in June, 1913, for the work of remodeling.



Poultry Husbandry building, third floor plan

On the third floor is the auditorium (375), with a seating capacity of two hundred and fifty-one persons. East and west of the auditorium are large laboratories (300 and 350), having equipment to accommodate one hundred and twenty-five students and sixty-five students, respectively. On the north side, across the corridor from the auditorium, is a recitation room (325). On this floor there are provided also a photographic laboratory and dark room (351 and 352), and a preparation room for lecture charts and materials. In the corridor of this floor is a museum case containing anatomical specimens and other materials used for exhibition and instruction.

In the attic are two dormitory rooms.

The basement contains the refrigerating machinery and the refrigerating box. Here is also to be found machinery for operating the water-pressure and steam-supply systems. Three mammoth incubators, each having a capacity of three thousand eggs, a number of smaller incubators, dark rooms for testing eggs, and a room for storage occupy the remainder of the basement.

Auxiliary buildings, to provide accommodations for instruction in practice courses, are to be constructed during the fiscal year 1913-1914, north, east, and west of the new Poultry Husbandry Building. These buildings will consist of houses for egg production, a fattening house, a breed-observation house, two pipe-system brooding houses, and a main building for feed and supplies. In one of these buildings will be a pigeon loft. The buildings are to be constructed from an appropriation of $25,000 made by the Legislature in 1913 for the purpose.

NEW ANIMAL HUSBANDRY BUILDINGS

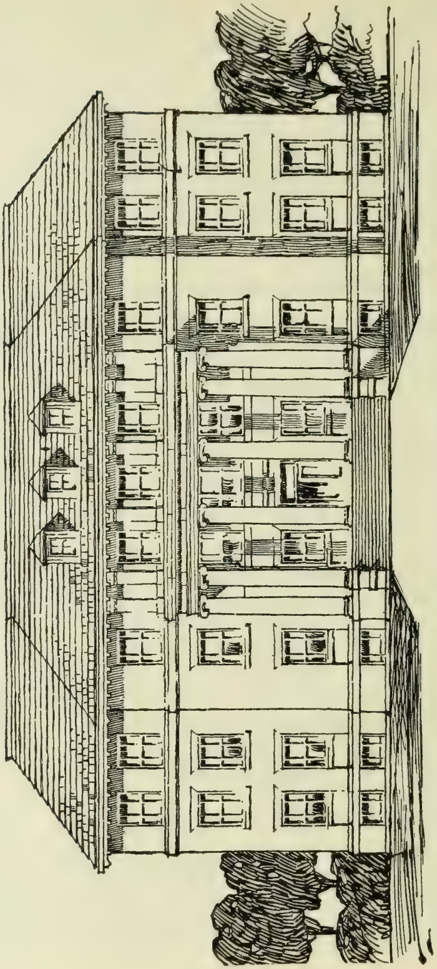
The last buildings to be reached as the visitor travels eastward toward the farms are the new buildings for the Department of Animal Husbandry, which are located at the eastern end of the university playground and near the new college barns. The buildings are two in number, a general classroom and office building and a judging pavilion.

In the basement of the main building will be placed locker and storage rooms, laboratories for milk-testing and meat-curing, and a farm slaughter room. A large refrigerator will be installed for cooling meats and holding them for a short period. Space will also be reserved in the basement for housing such small animals as guinea pigs, white rats, and pigeons, needed for experimental breeding purposes.

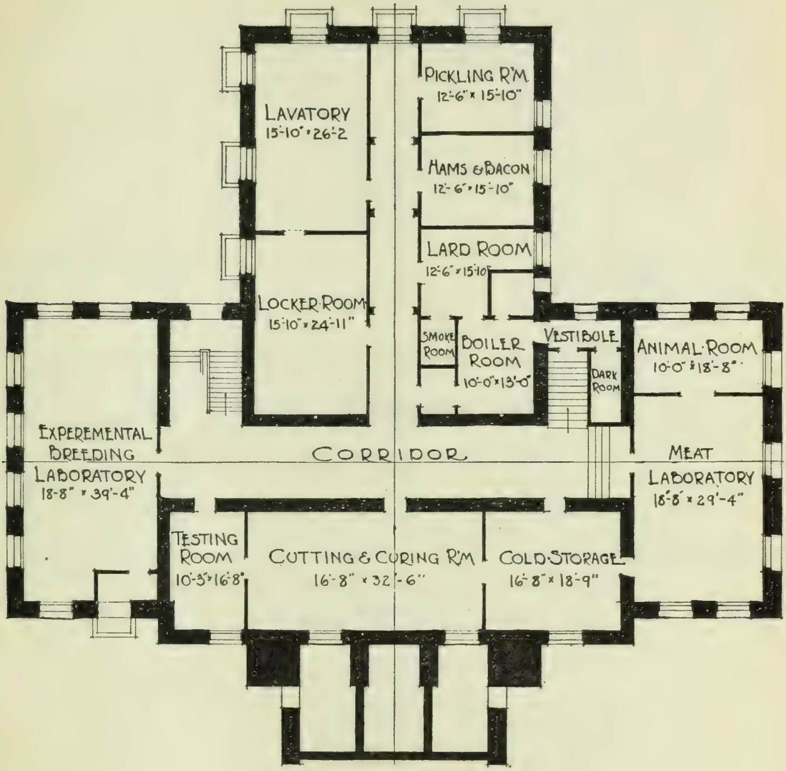
On the first floor the main lecture room, forming a wing on the east side of the building, will have a seating capacity of about three hundred persons. Small rooms suitable for the preparation of demonstration material for lecture work will be provided in the easterly corners, and from these rooms animals may be brought before the classes. On the first floor will be the general offices and the offices of the head of the department, a large classroom, and a seminar room. Here will be found also the advanced registry room, where the records of the official testing of pure-bred stock, supervised by the Cornell University Agricultural Experiment Station, will be kept.

The second floor will be given over to the study of animal nutrition, and facilities will be provided for laboratory work requiring the use of microscopes. A large laboratory for the study of feeds and for general classroom work will be provided. The professor having this work in charge will have his offices on this floor.

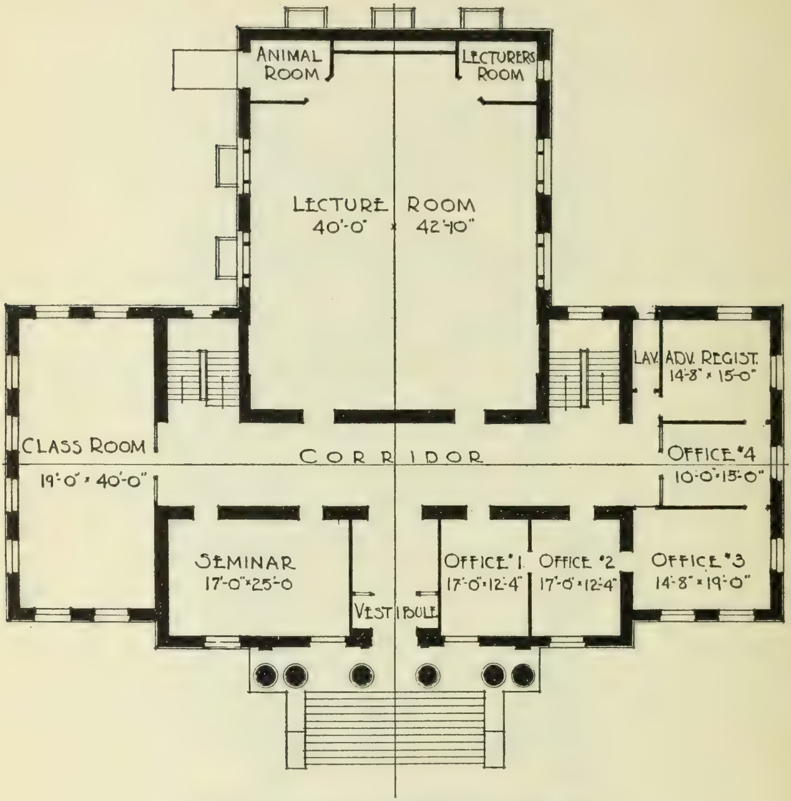
The third floor, similar in plan to the second, will be used for the study of the principles of breeding. Here will be located the library containing the herd and flock books of the different breeds. A combined reading room and students' room will contain periodicals relating to animal husbandry. Offices and rooms for graduate work will also be provided on this floor.



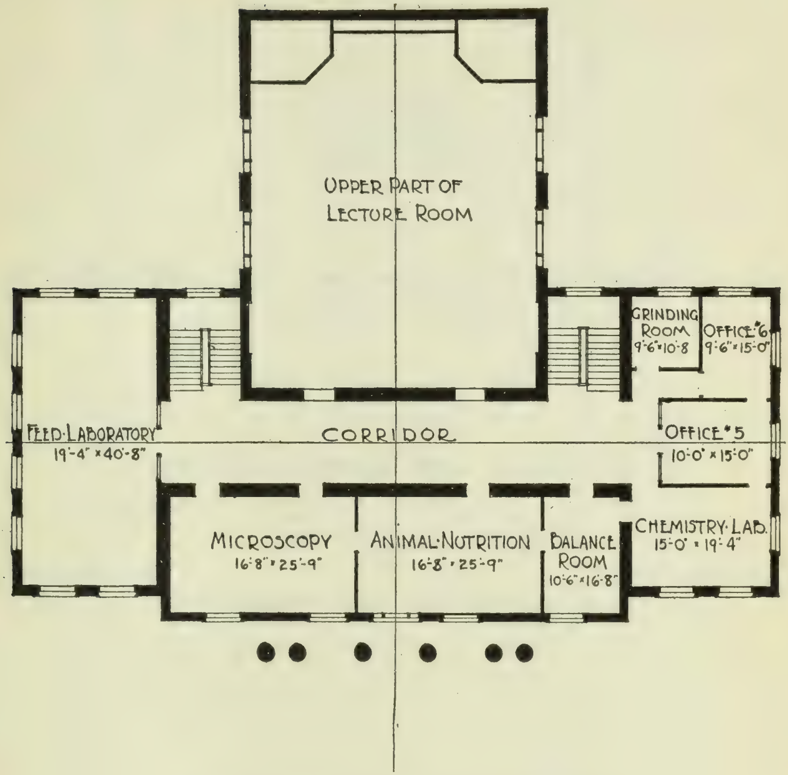
The new Animal Husbandry building



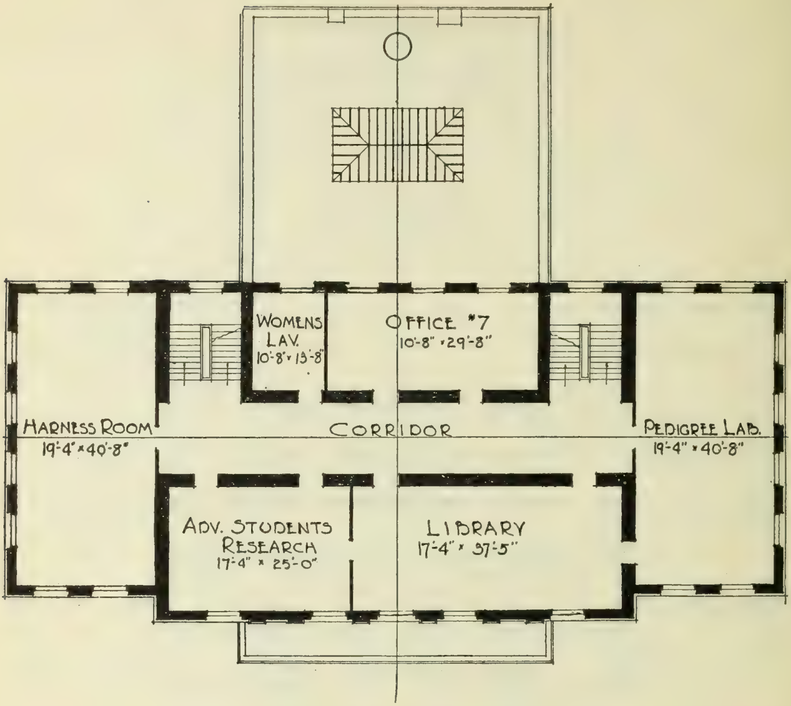
Animal Husbandry building, basement floor plan


ANIMAL ROOM
LECTURERS ROOM
LECTURE ROOM 40'-0" × 42'-10"
CLASS ROOM 19'-0" × 40'-0"
CORRIDOR
LAV.
ADV. REGIST. 14'-8" × 15'-0"
OFFICE #4 10'-0" × 15'-0"
SEMINAR 17'-0" × 25'-0
VESTIBULE
OFFICE #1 17'-0" × 12'-4"
OFFICE #2 17'-0" × 12'-4"
OFFICE #3 14'-8" × 19'-0"

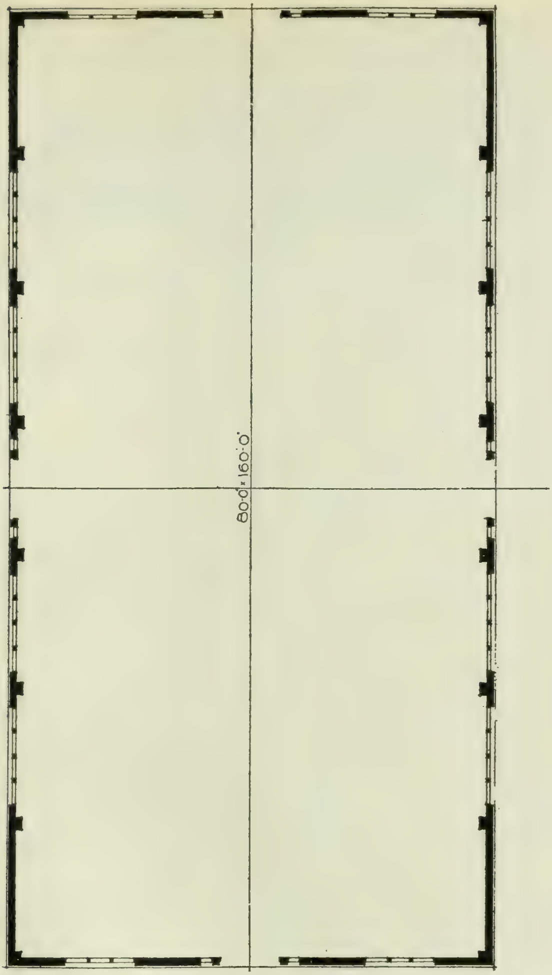
Animal Husbandry building, first floor plan


UPPER PART OF
LECTURE ROOM
GRINDING ROOM 9'-6"×10'-8
OFFICE #6 9'-6"×15'-0"
FEED·LABORATORY 19'-4"×40'-8"
CORRIDOR
OFFICE #5 10'-0"×15'-0"
MICROSCOPY 16'-8"×25'-9"
ANIMAL·NUTRITION 16'-8"×25'-9"
BALANCE ROOM 10'-6"×16'-8"
CHEMISTRY·LAB. 15'-0"×19'-4"

Animal Husbandry building, second floor plan



Animal Husbandry building, third floor plan



The stock-judging pavilion, ground floor plan

Judging pavilion.— The judging pavilion is to be a one-story structure, one hundred and sixty feet long and eighty feet wide, so arranged that the interior may be divided into two or more rooms by means of screens.

The stock-judging pavilion

The center of the building is to have a tanbark floor sufficiently large to exercise a horse. Around the sides of the room will be seats for four or five hundred persons.

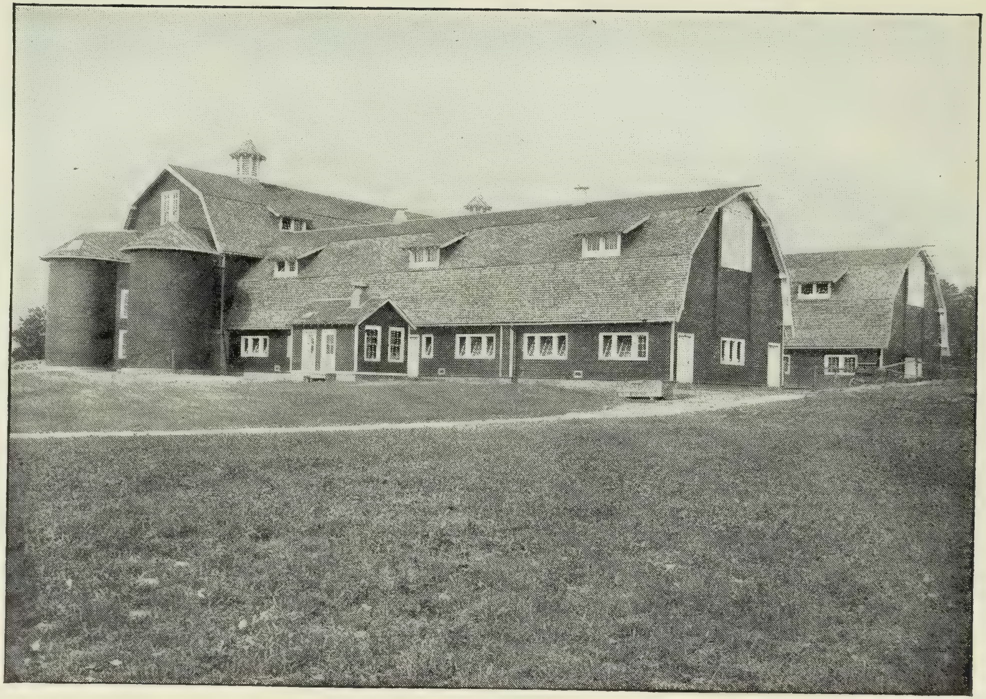
THE FARM BARNS

In keeping with the development of the general instructional work of the College, there have been added in recent years two large, modern barns, one for cattle and one for horses. In 1913 the Legislature made provision for a sheep barn, a hog barn, and a tool barn. The barns are grouped together and are situated east of the new Animal Husbandry buildings and across the highway known as the Judds Falls Road. The barns and the necessary lots and paddocks occupy approximately ten acres of land.

THE HORSE BARN

This is the first barn reached by the visitor after crossing the Judds Falls Road. It consists of a main part one hundred and twelve feet long and thirty-seven feet wide, and two wings each one hundred and ten feet long and forty-two feet wide. The first floor of the main part is occupied largely by a carriage room, a hitching floor, a water and washing floor, a training room, and a room for medical supplies. The second floor is occupied by an office, a grooms' room, bins for concentrated feeds, a mixing floor, and a storage room. The third floor is used for the storage of hay, bedding, and the like.

The ground floor of the north wing is occupied by standing stalls, straw chutes, harness cupboards, watering troughs, and the like. There are thirty-nine standing stalls. The south wing is similar to the north wing, except that it contains twelve box stalls and sixteen standing stalls. The box stalls are used for the breeding stock and the young stock. In both wings the



The main cattle barns

The farm barns: horse, left; cattle, right. Manure shed in center second floor is used for storing hay and bedding. The barn is equipped with labor-saving devices, such as feed- and litter-carriers, hay forks, grain and hay chutes, and the like.

Between the two wings is a large triangular paved court, used for hitching and for storing farm wagons and other tools in daily use.

THE DAIRY BARNS AND SILOS

The dairy barn is built on the same general plan as is the horse barn, but it faces toward the north whereas the horse barn faces toward the east. The three silos and the milk house are west of the dairy barn and connected with it. Each of the silos is sixteen feet in diameter and twenty-six feet high, and holds approximately one hundred and twenty-five tons. The main floor of the dairy barn is one hundred and twenty feet long and thirty-eight feet wide, and the wings are each one hundred and eight feet long and thirty-six feet wide. The ground floor of the main barn is occupied with grain-mixing rooms. an office, a wash room, a locker room, a root cellar, a tool room, and six box stalls for bulls and young stock. The second floor is taken up by a grooms' room, four rooms for the storage of grain, and two general storage rooms. The third floor is used for storing hay and bedding.

The ground floor of the west wing is equipped with fifty-four stalls for dairy cattle. This wing is provided also with a milking machine. The east wing is to be equipped for conducting feeding experiments with beef cattle as soon as the sheep barn is completed. The second floor of each wing is used for storing hay and bedding.

The milk room and pump room is sixteen by twenty-two feet in size, and is well equipped with milk-cooling devices, a gasoline engine for running the pump and the milking machine, and a 1500-gallon water tank.

MANURE PIT, PIG HOUSE, AND SHEEP QUARTERS

A large manure pit, seventy-eight feet long by eighteen feet wide, is located south of the west wing of the dairy barn. The pit is so arranged that team and wagon can pass through from end to end and the manure can be dumped directly into the wagon. At present the pig house is located south of the east wing of the dairy barn. It is a structure sixty feet long and twenty feet wide. There is a storage room in one end where feed is mixed and prepared for the hogs, and there are ten eight-by-ten-foot pens with small yards attached. At present the sheep are kept in the east wing of the dairy barn.

OTHER FARM BARNS

There are several outlying barns used for housing the animals owned by the Department of Animal Husbandry. Chief among these is the Mitchell barn, equipped for housing dry cows, young stock, and two teams of horses. There is a silo in connection with this barn. The barn on the Blair farm is equipped for housing young calves. It has a concrete silo attached.

THE FARM ANIMALS

DAIRY HERD

The Holstein dairy herd at Cornell University had its beginning about the year 1875, when Professor I. P. Roberts made the first purchase of a pure-bred bull. The cows in the herd at this time, about twenty in number, were common ones that had been procured in the neighborhood as opportunity offered. Although no records were kept, we have Professor Roberts' authority for the statement that the average production did not exceed three thousand pounds of milk in a year. The first bull purchased, a Holstein, was known as Sixth Earl of Middlesex, 156. He was purchased of Winthrop W. Chenery, of Belmont, Massachusetts, the first importer of Holstein cattle; and his dam, Zuyder Zee, was one of Mr. Chenery's first importations. Three of the cows in the herd to-day carry the blood of this original bull, and therefore represent in themselves the history of the Holstein breed in the United States. The successors of the original bull in the Holstein herd have been, in order: Van Horn, 361; Robinson Crusoe, 1471; Netherland Remus, 6276; Netherland Statesman's Excelsior, 19,036; Sir Beets De Kol, 21,422; Earl Korndyke De Kol, 24,954; Dutch Hengerveld Korndyke, 31,155; Small Hopes Korndyke De Kol, 32,260; Prince Ybma Spofford 6th, 34,709; and Woodcrest Pietje Ormsby, 54,909. There were thus eleven bulls in a period of thirty-eight years, or an approximate average life of three and one half years for each bull. Although no extraordinary pains were taken in the selection of these bulls and no very high prices were paid for them, they all proved successful as sires and served to increase, to a greater or less extent, the productivity of their offspring. Of the eleven, Van Horn and Dutch Hengerveld Korndyke were the least successful. Earl Korndyke De Kol was the most impressive sire and proved of the greatest use in the herd. The bull at the head of the herd at the present time gives promise of being equally useful and, in point of conformation, is clearly the best individual of the lot.

For many years the herd was maintained solely as a grade herd. The production increased rapidly above that of ordinary cows, however, and by 1890 it had reached an average of seven or eight thousand pounds of milk per cow each year, with individual records running as high as twelve or fourteen thousand pounds. Since 1900, purely bred animals have largely replaced the ordinary grade cows; but there still remain in the herd three grade cows, and attention is called particularly to these animals. They are Zelma and her two daughters, Charity and Aurora. It is proposed to retain these animals and their descendants in about the same number, as a memorial to the successful labors of Professor Roberts in increasing the production of the dairy cow.

In 1883 a pure-bred Holstein heifer was purchased. This heifer was called Dena. She was descended from an importation made from Holland by

Professor Roberts for Howard G. White, of Syracuse, in 1878. This cow did not prove successful either as a producer or in leaving progeny. In 1889, when the herd came under the present management, a single granddaughter of Dena was the only representative of purely bred Holsteins in the herd. This cow, known as Glista, 7856, is the ancestor of all pure-bred Holsteins in the herd at the present time. She was rather inferior as a producer, but having been bred to such bulls as Netherland Remus, Earl Korndyke De Kol, and Small Hopes Korndyke De Kol, she and her offspring founded a family fairly uniform in type and of good average production. The animals in the herd at the present time fairly represent the family, and are mostly in the fourth or fifth generation from the original cow.

Jersey cattle were introduced into the herd about 1885. The bulls used have been Cornell Valentine, a son of Pedro; Cornell Exile, son of Exile of St. Lambert; Marvel's Pogis, a descendant of Emma's Pearl; and Oonan's Count Third. The present sire, Blue Belle Experimenter, a gift of the State Experiment Station at Geneva, descended through the herd of George W. Sisson from an imported cow, Blue Belle, and is as good a representative of the breed as has ever been in the herd.

Guernsey cattle were first introduced in 1903. They have not been remarkably prolific. The present herd bull, Ledyard's Warwick, is a full brother of Otto W. Post's cow, Azucena's Pride 2d, the champion of her class (at both two and a half years and four years of age) in the Advanced Registry of the American Guernsey Cattle Club. The record of production of this cow is 706.46 pounds of butter-fat in one year at two and one half years of age, and 855.7 pounds at four years.

Shorthorns.— In 1905 it was thought wise to introduce the so-called Dairy Shorthorns, and two cows and a heifer were purchased from the herd of Innes and May, of Pennsylvania. Afterward a bull, Frederick Clay, was purchased from the same herd. The descendants of these animals have proved prolific and rather productive, particularly the cow Lady Clay 3d, to which attention is called. The present herd bull, Royal Oxford, bred by Horace W. Avery, is descended from the best milking strains in Vermont.

Ayrshires.— The latest additions to the herd have been Ayrshires, which were introduced in 1911, largely from importations made directly from Scotland by F. S. Peer, of Ithaca. One of the cows comes from the noted producing herd of S. S. Karr and Son, of Allegany county, New York.

HORSES

On the university farms there are fourteen teams of work horses, five driving horses, three stallions, two three-year-old colts, ten two-year-olds, eight yearlings, and four foals. Of this number twelve are brood mares, of which four are pure-bred Percherons and two are high-bred coach mares. Of the two-year-olds, four are pure-bred Percherons; and of the yearlings, three are pure-bred Percherons. The other colts are grade Percherons with three exceptions, which are Hackneys.

In March, 1910, the Department of Animal Husbandry purchased the Percheron stallion Negro, 64,251, from E. S. Akin, of Auburn, New York. This stallion was imported by J. O. Singmaster. Negro was placed in the stud and we now have two crops of his colts. In May, 1910, Honorable F. C. Stevens, of Attica, New York, presented the University with the Hackney stallion Volunteer, 1214, by Langton Performer 242, out of Lady Valentine 784. Volunteer is thus one of the best-bred Hackneys in the country. During the summer of 1912, F. S. Peer, of Ithaca, imported the gray Percheron, Jantier, 84,850, for the Department of Animal Husbandry. These stallions are all in service at the university barns.

All these horses are at the disposal of the department for instruction and experimentation. The teams are employed on the farms and experimental lands. They also draw the freight and the entire coal supply for the University, the latter amounting to seventy to one hundred and twenty-five tons daily in winter.

Each year the department purchases a carload of horses for class work in order that students may receive instruction in training and fitting horses for sale.

SHEEP

For a number of years the college flock of sheep has been managed for the production of hothouse lambs. Until 1910 the flock consisted of about fifty ewes, all of which were pure-breds, or high grades. Some of the grade ewes had been raised on the farm but all the pure-breds had been purchased. There were a few pure-bred Dorset, Southdown, Shropshire, Cheviot, Hampshire, Rambouillet, and Delaine ewes. The rams were usually one of the Down breeds. All winter lambs were sold as hothouse lambs and only the late lambs were raised. It was not deemed advisable to raise lambs worth eight to ten dollars at ten weeks old when good breeding ewes could be purchased for less money.

For the past two years the sheep have been divided into four flocks. The Dorsets. Rambouillets, and Shropshires have been kept as pure-bred flocks. The Cheviots, Hampshires, Southdowns, Delaines, and grades have been continued as a hothouse-lamb flock. From a carload of western lambs fattened in 1910–1911, twenty ewes were selected for the hothouse-lamb flock.

The plan is to raise each year the first ten ewe lambs born, these lambs to be used for replenishing the hothouse-lamb flock. Thus by selecting the earliest lambs it is hoped to develop a flock that will breed early lambs. At present there are nine yearling ewes, born in the winter of 1911–1912.

Last year several Shropshires and Dorsets were purchased. At present the flocks are composed of forty-five Shropshires, six Dorsets, and sixteen Rambouillets. In addition to these sixty-seven pure-bred ewes there are three pure-bred rams, a Shropshire, a Dorset, and a Rambouillet.

All the sheep are kept in the east wing of the cattle barn.

SWINE

While swine husbandry at Cornell University is not so extensive as are some of the other branches of live-stock industry, perhaps it holds as important a place on the university farm as it does on the average farm in the State of New York. This, however, is not the reason that the breeding of swine has not received more attention. The reorganization and development of the College has been so recent that the swine industry has not come into its own as yet. When sufficient and better accommodations are provided by the appropriations of the recent Legislature, the breeding of swine will receive the attention that the Department of Animal Husbandry desires to give to it.

The breeding stock at present consists solely of Cheshires. Other breeds are used from time to time for experimental and educational purposes, but they are not bred on the farm.

The Cheshire herd was founded in 1903 by the purchase of a pair of pigs from R. D. Button, of Canastota, New York. These pigs were called John H., 1350, a boar, and Co-Ed, 3154. Sows other than this one have not been purchased, but have descended directly from the original sow in the female line. The boars used in the herd have been purchased from prominent herds. The second boar was Dandy's Best, bred by E. S. Hill, of Freeville. The next, and perhaps the most important, was The White Chief, bred by S. G. Otis of Sherwood. June Jap, bred by Mr. Button, of Canastota, was used next, followed by Morningside Cornellian and Castilian, bred by F. W. Card, of Pennsylvania. Morning Star, a very promising young boar from the university herd, was selected and used along with Cornell Boy, bred by G. E. Smith, of Castile. The present head is a very fine individual called White Sox, bred by Mr. Otis.

The herd has had a short and limited show record, but one with which any breeder might be well pleased. The White Chief was Grand Champion as a pig at the New York State Fair in 1906, and won the same distinction again in 1908. He proved very successful as a sire and his stock has won many prizes.

The herd has never been shown at any place other than the New York State Fair, in the years 1908, 1909, 1910, and 1911, except at the International Live Stock Exposition in 1905, where it won first in the Carcass Class on a pig that weighed 215 pounds alive, and dressed 194 pounds, or 90.23 per cent. This is the highest percentage on record. In 1908 the herd won eleven prizes at the New York State Fair, in 1909 sixteen prizes, in 1910 thirteen prizes, and in 1911 seventeen prizes.

Barrows in the herds at different times have dressed at one year of age 82 to 86 per cent and have weighed four hundred pounds. This fact, combined with prolificacy, smoothness of form, and adaptability to New York State conditions, makes them a valuable breed and entitles them to the name frequently given them — " The New York State Farmer's Hog."

THE COLLEGE FARMS

The New York State College of Agriculture owns 766 acres of land and rents 150 acres more, making a total of 916 acres under college management. These farms are run not for commercial, but for educational, purposes, and farm practices are therefore modified to meet the varied demands of the institution.

Land in the vicinity of the College is very broken, abounding in hills and dales, brooks and gorges. In consequence, less than one half of the total area is now available for tillage. Of the 916 acres, 508 are classified as arable, 188 as pasture, and 133 as wood and waste, 48 are devoted to college campus, buildings, and old orchards, and 39 are retained for other uses.

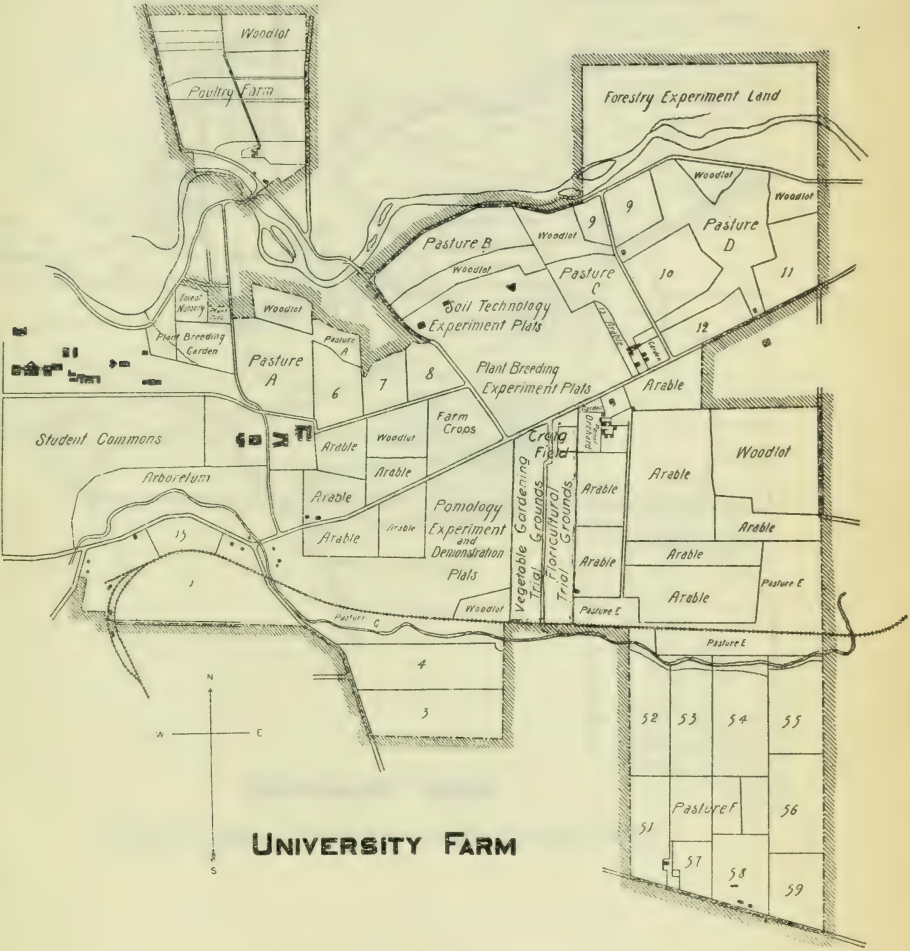
Of the tillable area, 45 acres have been laid out in permanent experiment plats for the use of the departments of Soil Technology and Plant-breeding; 50 acres have been assigned to the Department of Pomology and are largely planted to young trees; 45 acres have been assigned to the departments of Floriculture and Vegetable-gardening; 73 acres to the Department of Poultry Husbandry; 9 acres to farm-crops garden and experiments; and there are left to the departments of Farm Practice and Farm Crops 286 acres on which the regular farm operations may be conducted. The numbered areas on the accompanying maps are those under the management of this department. Fields 1, 15, and 9, comprising about 30 acres, are in alfalfa and will probably be kept in this crop. The remaining 256 acres, divided into 23 fields, many of them of small size and irregular shape, are devoted to the raising of the regular farm crops grown in rotations.

The soil of the college farms is heavy, nearly all of it being Dunkirk clay loam. A few fields at the extreme southeastern corner are Volusia stony loam. The Dunkirk clay loam is entirely unsuited to potatoes and is not well adapted to corn, but will grow fair crops of corn if heavily manured. It is well adapted to wheat, oats, timothy, and clover. The Volusia stony loam is well adapted to corn and potatoes, if it is well drained and is freed from stones. The recently acquired areas meet neither of these requirements.

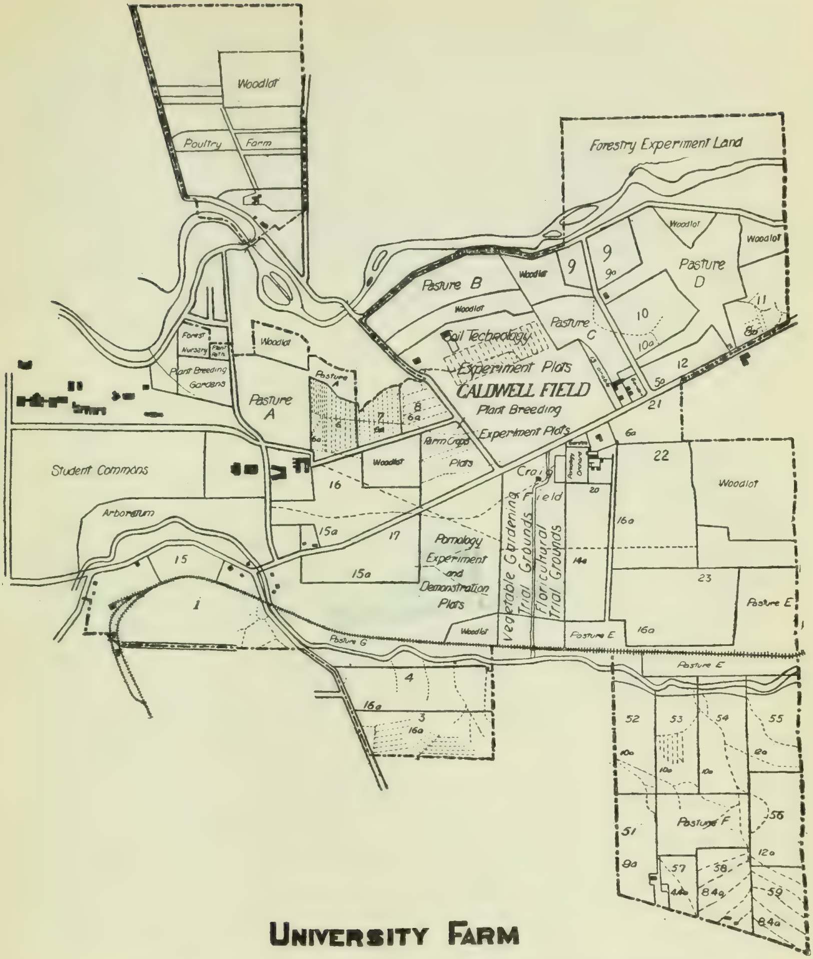
In order that they may be readily accessible from the college buildings, the principal barns have been located at the extreme western end of the large farm domain. This location necessitates a very long haul for a large part of the farm crops and of the manure, entailing a heavy labor cost.

FORMATION, TOPOGRAPHY, AND SOILS

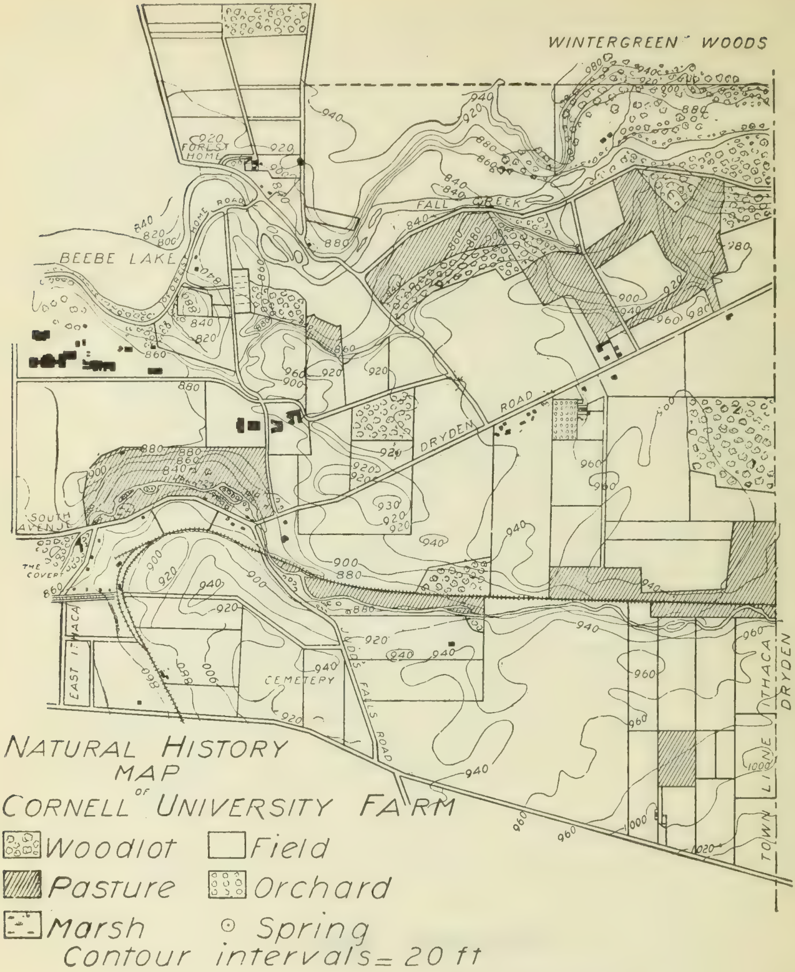
The university farm is situated on a bench of land on the east side of Cayuga valley, midway between the level of the lake and the higher hills that form the upland. This bench was formed by the deposition of sediment, sand, and gravel in a lake that occupied the valleys of this region up to an elevation of nearly eleven hundred feet above sea level. The lake developed during the retreat of the mass of glacial ice that at one time covered nearly all of New York State.



Map of the Cornell University farm



University farm. Dotted lines indicate drainage systems



Natural history map of Cornell University farm

The surface of the bench is an undulating plain cut by Fall and Cascadilla creeks, which are situated one on either side of the main body of the farm. The general elevation of the plain is from nine hundred and seventy feet on the eastern margin to nine hundred and forty feet on the western margin. The gorges of the two creeks mentioned are thirty to sixty feet deep and one eighth to one half mile wide, with steep sides and with a strip of level land in the bottom which is subject to overflow.

The floor of the plain consists of a thick formation of chocolate-brown, somewhat stony, clay loam. This represents the fine sediment brought into the lake by the streams and by the melting of blocks of ice that floated on its surface — the latter accounting for the boulders occasionally found in the fine clay material. Toward the latter stages of the lake the movement of water was more pronounced, and a thin layer of silt was deposed over the clay. On a few high points fine sandy loam was accumulated.

At another time streams emptying into the lake brought in masses of gravel and sand that were deposited on the clay in the form of fan-shaped deltas and undulating hills. On the extreme southeast corner of the farm is a small area of heavy, shaly silt-loam soil formed directly by the glacial ice sheet.

These geological processes are responsible for the Dunkirk clay loam and the silty clay loam that make up the greater part of the farm area. On the western side of the farm are small areas of Dunkirk fine sandy loam and gravelly loam. The name " Dunkirk " is applied to all those light brown soils in the western part of New York that were formed in glacial lakes. Such soils are extensively developed in the region north of the latitude of Ithaca and up to an elevation of eight hundred to a thousand feet.

In a few depressions of small extent swamps formerly existed, and the resulting soil has a dark or black color. These are classed with the Clyde series and are represented on the farm chiefly by the Clyde clay loam.

In the bottoms along the creeks the dark alluvial soils resulting from overflow, which range from a silt loam to a gravelly loam, are classed with the Genesee series, which includes most of the first bottom land in the State.

The glacial shaly silt-loam soil on the southeast corner of the farm belongs with the Volusia silt loam and is fairly representative of large areas of hill land in southern New York.

There are a number of other types of soil, of minor extent, associated with these three series.

All the land on the farm is deficient in lime and the soils are normally low in organic matter. All except the sand and gravel soils require underdrainage for their best utilization. Even some of the sand and gravel soils require drainage along the line of contact with the underlying clay. With total plant-food they are all well stocked, in which feature they agree with large areas of soil in the State. Under poor management the crop yields decrease rapidly, but with good handling these soils give large yields of the crops grown in the region.

THE LAYOUT OF THE FARMS

In planning the cropping scheme, or rotations, for the farms, three considerations have been kept in view — the soil adaptation, the long haul, and the forage requirements of the live-stock. Fortunately, these considerations harmonize in the main. The heavy soil and the long haul make the growing of the desired amount of corn for silage a difficult task. It is on this point that the rotations hinge. The needed silage cannot be purchased elsewhere. A surplus of silage or corn fodder could not be disposed of. Sufficient silage corn is grown, so far as possible within easy hauling distance of the barns. Besides the corn, the farms raise oats, wheat, clover, timothy, and potatoes, because they are adapted to the soil and are needed at the barns or are of ready sale.

In planning the rotations, the 23 fields are divided into five groups. *The first group*, comprising fields 6, 7, 8, 11, and 12, is located convenient to the silos, and therefore should be made to produce as much corn as is practicable. This land is in corn for two years out of five. The rotation is: first year, corn; second year, corn; third year, oats; fourth year, wheat; fifth year, clover. The aim is to grow the first crop of corn on the clover sod without manure, to sow in the corn at the last cultivation a catch-crop of rye, to apply manure, and to plow down both manure and rye for the second crop of corn. Timothy seed is applied in the fall with the wheat, and clover in the spring. The corn stubble is plowed in the fall, so as to be ready for the early sowing of oats. The oat stubble is broken immediately after harvest, in order to give as long a time as possible for fitting the land for wheat.

The second group is composed of fields 3, 4, 16, and 17. Two of the fields are near the barns and two are rather remote from them. On these fields the rotation is corn, oats, wheat, and clover. This land bears corn once in four years.

The third group comprises fields 10, 20, 22, 23, and a combination of 21 and 24. These fields are so remote from the main barns as to make the hauling of silage from them expensive. No more corn is grown on them than is necessary. It is found that a crop of corn on this land once in five years will probably meet the requirements. The rotation adopted, therefore, is: first year, corn; second year, oats; third year, wheat; fourth year, clover; fifth year, timothy.

The fourth group comprises fields 51, 52, 53, 55, and 56, on the southeast farm. This farm is so far from the state barns that the hauling of silage is prohibitive. This land, therefore, is devoted as fully as possible to the production of hay; nearly all of it is in hay now. It is planned to break this land after haying, fit and sow to winter grain or oats, seed back to timothy and clover, and mow for four years. Manure may be applied as a top-dressing to the grass or when the land is broken. Nitrate of soda may be used in order to increase the yield of timothy. This rotation is still in the experimental stage. If it is found that a field of corn is desired for the grain and dry fodder, corn can be grown when the land is broken.

The fifth group comprises fields 57, 58, and 59. These fields are practically the only ones on the college domain that are at all well adapted to potato growing, and these are not in satisfactory condition for this use because they are very stony and water seeps from the hill on the south and keeps them wet for a long time after wet weather. Drainage and clearing will correct this condition.

A short rotation — first year potatoes, second year oats, and third year clover — has been adopted for this group. It is the practice to plow the sod in fall for rye, apply manure during winter, and plow down for potatoes in spring. This provides a well-rotted sod and additional organic matter.

The cropping scheme.— It is desired to call attention to the fact that, while such a cropping scheme may seem rather ironclad and not suited to variable needs, it really is very adaptable. If it is found that the rotations give more corn than is desired, the sod field in the first group that is due to be broken for corn may be mown a second time, this giving two crops of hay instead of two crops of corn. If it is found that the area of corn must be increased, part of the land in the third group may be broken after mowing once, instead of after mowing twice, and may be made to grow two crops of corn in five years instead of one. If the rotation gives too little hay and no corn area can be spared, wheat may be dropped out of the rotation and the seeding may be done in the oats; thus an extra year of hay may be gained.

If, owing to a very wet autumn, it is impossible to do the usual wheat seeding, the area intended for wheat may be sown to oats in spring and the meadow seeds added at this time.

If a crop of roots or cabbage is desired, it may be given a small area on the land that is to grow corn for the second time. None of these variations disarrange the general cropping scheme in the least.

While a large number of crops are not grown in the farm rotations, field 5 has been set aside as a farm-crops garden and demonstration area. Here every crop that can be grown in this region will be planted and demonstrations of cultural methods will be made.

Owing to differences in the size of fields, the annual planting of the several crops will vary somewhat; the following shows what the average areas will be:

Potatoes	7 acres	Roots	3 acres
Corn	44 acres	Clover	55 acres
Oats	50 acres	Timothy	48 acres
Wheat	34 acres	Alfalfa	30 acres

The cropping scheme described above is not yet fully in operation. The following table shows the areas planted in 1913:

Crop	Acres	Fields
Corn	38	3, 8, 20, supplementary plats
Oats	59	4, 12, 23, 51, 59, supplementary plats
Oats and peas	6	7
Japanese millet	6	6
Wheat	24	11, 22
Alfalfa	30	1, 9, 15
Clover	24	10, 16, 58
Timothy and mixed hay	57	16, 21, 52, 53, 55, 56
Potatoes	4½	57
Roots	3	Pomology plats
Buckwheat	15	17

The following table shows the rotation practiced on the several groups of fields and the crop to be planted on each field each year. Since this scheme takes the place of another, which was interrupted by the assignment of certain fields to other uses and by the acquisition of new fields, a few of the fields cannot be cropped as indicated for a year or two.

	Field	Acres	1913	1914	1915	1916	1917
Group 1. A five-course rotation, allowing two crops of corn from each field in five years	8	6	Corn	Corn	Oats	Wheat	Clover
	6	6	Corn	Oats	Wheat	Clover	Corn
	7	6	Oats	Wheat	Clover	Corn	Corn
	11	8	Wheat	Clover	Corn	Corn	Oats
	12	5	Clover	Corn	Corn	Oats	Wheat
Group 2. A standard four-years rotation	3	16	Corn	Oats	Wheat	Clover	Corn
	4	16	Oats	Wheat	Clover	Corn	Oats
	17	15	Wheat	Clover	Corn	Oats	Wheat
	16	15	Clover	Corn	Oats	Wheat	Clover
Group 3. A five-years rotation, with two crops of hay	20	14	Corn	Oats	Wheat	Clover	Timothy
	23	16	Oats	Wheat	Clover	Timothy	Corn
	22	16	Wheat	Clover	Timothy	Corn	Oats
	10	10	Clover	Timothy	Corn	Oats	Wheat
	21 24	16	Timothy	Corn	Oats	Wheat	Clover
Group 4. A five-years rotation for hay. If corn for husking is desired it can have place here	51	9	Oats	Clover	Hay	Hay	Hay
	53	10	Hay	Oats	Clover	Hay	Hay
	52	10	Hay	Hay	Oats	Clover	Hay
	56	12	Hay	Hay	Hay	Oats	Clover
	55	12	Clover	Hay	Hay	Hay	Oats
Group 5. A three-years potato rotation	57	4.4	Potatoes	Oats	Clover	Potatoes	Oats
	59	8.4	Oats	Clover	Potatoes	Oats	Clover
	58	8.4	Clover	Potatoes	Oats	Clover	Potatoes

DESCRIPTIONS OF THE FIELDS

(See maps)

A few notes regarding some of the fields most readily accessible to visitors may be of interest. Immediately following are descriptions of the fields under the management of the Department of Farm Practice. The fields assigned to other departments for their special use are treated separately as follows:

- Plant-breeding Garden, page 2354
- Plant-disease Garden, page 2354
- Farm-crops Garden, page 2356
- Caldwell Field
  - Soil Technology Plats, page 2358
  - Plant-breeding Plats, page 2378
- Pomology Plats, page 2380
- Craig Field
  - Floriculture Plats, page 2383
  - Vegetable-garden Plats, page 2383
- Woodlots and Forest Lands, page 2384
- Poultry Farm, page 2384

Pasture A, directly north of the state barns, was seeded about ten years ago. The seeding was in the form of an experiment. The pasture was divided into strips running north and south, and the strips were seeded with different kinds of grass and with various combinations of grasses. The chief point of interest at the present time is that the differences in the original seeding have nearly all disappeared and that Kentucky blue grass has come to be the prevalent pasture grass over almost the entire area. This points strongly to the conclusion that for permanent pastures Kentucky blue grass is the most important of all grasses.

Fields 6, 7, and 8, northeast of the barns, are in a rotation of corn, oats, wheat, clover, corn. The soil in these fields is rather heavy, and until the land had been drained and considerably improved by manuring and thorough tillage it produced very unsatisfactory crops. More recently it has been doing very well. In 1912 field 6 produced 3.7 tons of hay per acre, mostly timothy, and field 8 produced 3.2 tons of clover hay per acre.

Field 21 has been in hay for six or seven years. The College has had possession of it for four years. Each of these four years the soil has been treated with chemical fertilizers; two hundred pounds of nitrate of soda, one hundred pounds of acid phosphate rock, and fifty pounds of muriate of potash per acre have been used. In the first season, 1910, it was estimated by the previous occupant that the field would produce 1¼ ton of hay per acre; with the treatment given it actually yielded 3⅓ tons. In the following year it yielded 2⅝ tons, and in 1912 it yielded 3 tons, per acre.

Field 22, now in wheat, produced oats in 1912. The yield was a little over 75 bushels per acre, machine measure. Owing to an exceedingly wet autumn, it was not possible to sow wheat on this field until October 10. The wheat went into the winter in good condition; but it was so young and tender, and received so little protection from snow during the winter, that it killed out badly and the crop is only a fraction of what the land should bear.

PLANT-BREEDING GARDEN

Before the visitor reaches the university barns he will see down under the hill on the north, and just east of the heating plant, a plant-breeding garden of three and one half acres. This plot is used for the cultivation and propagation of special experimental plants. Some of the plants have economic value, and results of immediate practical utility are being obtained; but the experiments in this garden are mainly scientific studies of fundamental principles.

Daisies.— In the experiment with the common field daisy may be seen more than one hundred types of this wild plant, gathered from the surrounding region.

Oat hybrids.— There are a large number of second-generation oat hybrids, which have been produced with the view of obtaining new varieties by the combination of old varieties. These hybrids are of interest also to the scientific person who may desire to study the Mendelian segregation of characters.

Potato selections.— The pedigree selection of potatoes is conducted in this garden. This experiment has both a scientific and a practical bearing. The experiment is planned to determine the amount of bud variation that occurs in pure-tuber lines and the effect of selection within a pure-tuber line. The experiment will throw light also on the practical method of hill selection, the comparative vigor of the seed and the stem end, and other points of practical interest.

The buckwheat is planted for the purpose of furnishing a foundation stock from which individual selections may be made.

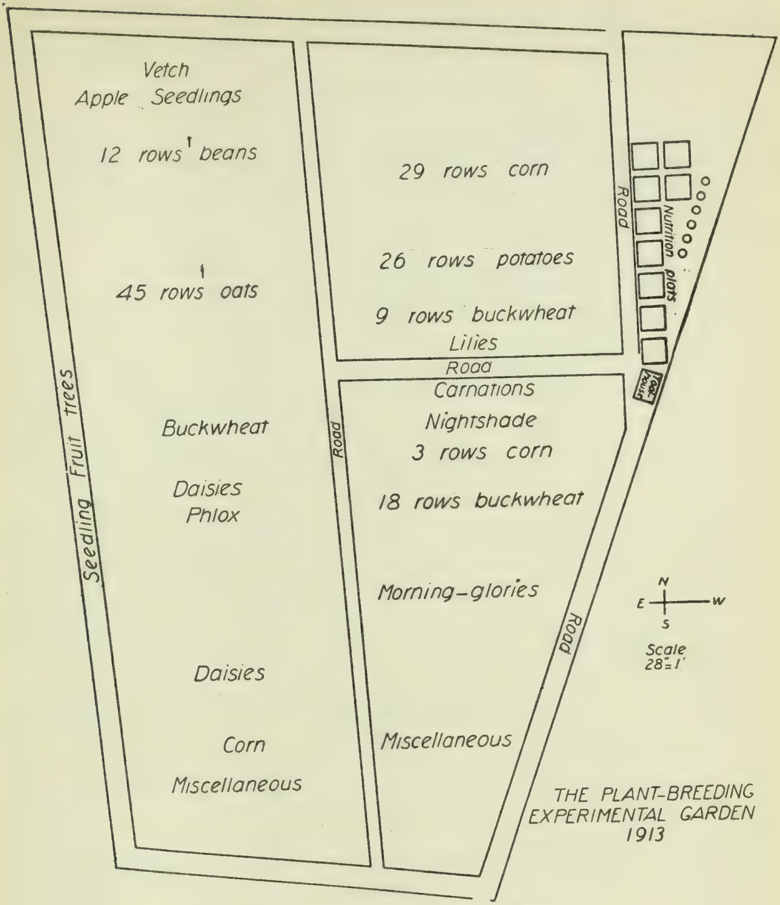
The corn consists of a number of pure strains of widely different types, and of hybrids that have been produced between these pure strains.

Wheat studies.— The series of beds in which wheat is sown are planned for the purpose of a long-time experiment on the effect of growing plants in soils of different degrees of fertility. In each series there is a bed of sand, one of ordinary garden soil, and one of highly fertilized soil. The progeny of the same plants are grown on the three beds each year. After a period of five years or more, all the plants will be compared on the same bed of ordinary soil in order to see whether there has been any accumulated effect due to previous growth under extreme conditions.

Other studies.— In addition to the plants mentioned, there are rows of morning-glories, pansies, tomatoes, nightshade, wonder berries, carnations, and phlox, all of which furnish material for research work in the Department of Plant-breeding.

PLANT-DISEASE GARDEN

Adjoining the plant-breeding garden on the north is a small plant-disease garden of about one acre in size, where a rather extensive experiment on the



The plant-breeding experimental garden effect of crown gall on the growth and fruiting power of apple and peach trees is being worked out. Diseased and healthy trees of several varieties are set alternately. Careful records are kept of the growth and fruiting of the different trees.

FARM-CROPS GARDEN

Field 5, east of the woodlot nearest the barns and consisting of 9 acres, has been set aside for a farm-crops garden. In this garden it is proposed to grow all varieties of common farm crops that can be matured in this climate, and in many cases the wild form of cultivated crops will also be grown. A part of the garden will be used to demonstrate well-established facts in crop production. The main purpose of the garden will be for the instruction of students.

The garden is laid off in eight ranges, beginning at the north. A brief description of the treatment of each range is here given:

Range 100. Varieties of economic plants, grasses, and legumes to be grown.

Range 200. Varieties of economic plants to be grown.

Range 300. Plats 306 to 333 are sown to fourteen of the common varieties of grasses and clovers, as indicated by names on the stakes. The northern half of each plat is to be cut for hay, while the southern half will be clipped often and kept close, as it would be if pastured. The object is to obtain some data on the relative production of the common grasses and clovers under pasturage or when grown for hay. The effect of the two treatments on the life of the crops will also be studied.

Plats 334 to 345. Heavy applications of fertilizer will be made to one section of each of these grass plats, and heavy applications of manure to the other section. The two treatments will be continued as long as the various grasses live, in order to note their effect on the life of the various grasses.

Plats 346 to 353. Timothy cut at four different stages of growth, from early bloom to ripe, in order to note the effect on life and yield of the crop.

Clover plats are maintained at the west end of range 300. These plats are kept continuously in the various kinds of clover, for demonstration purposes.

Range 400. The effect of nurse crops on the seedling is demonstrated on plats 401 to 437. Oats and barley were sown at various rates, varying from one to four bushels per acre, as indicated on stakes. Alfalfa, clover, and timothy were sown with all the rates of seeding, and alone.

Plats 438 to 442 in this range have been sown each month from May to September, in order to note the best time of seeding.

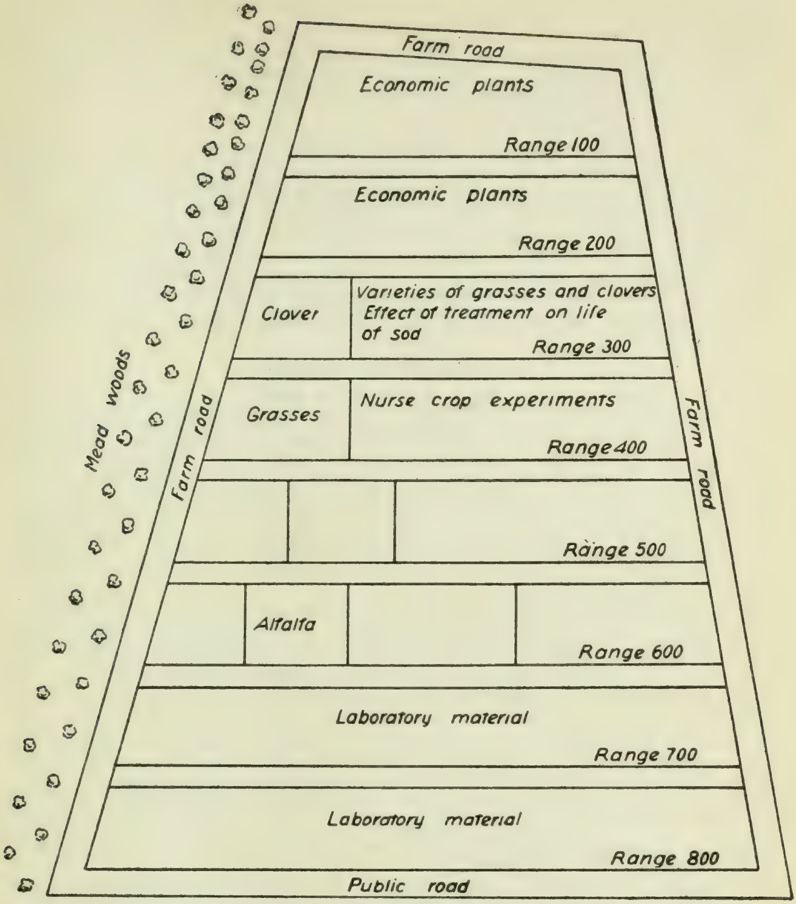
At the west end of range 400 is a series of plats demonstrating pasture, meadow, and lawn grasses.

Range 500. Test of flax, and variety tests of millet and buckwheat.

Range 600. Hardy alfalfa plats. Remainder of range is devoted to laboratory material.

Range 700. Laboratory material.

Range 800. Laboratory material.



Farm-crops garden

On field 3 is a series of plats limed at various rates. Across these plats the common legumes and a few grasses have been planted in plats. The object of this experiment is to obtain information on the relative amounts of lime required for growth by the different legumes. The experiment is repeated on the Hildebrand farm, about two miles south of this field.

CALDWELL FIELD

This field contains about forty-five acres, and is devoted to the field investigations of the departments of Soil Technology and Plant-breeding. The soil is classified as the silty phase of Dunkirk clay loam. The topography is rolling and the soil is rather non-uniform in its productivity. The field has been laid off in sections, which are numbered so as to enable visitors to find on the field any experiment described herein as being located on a certain section. In some cases the number of the block within the section and the plat numbers are also given, which will show exactly where the experiment can be found.

Soil Technology Experiment Plats

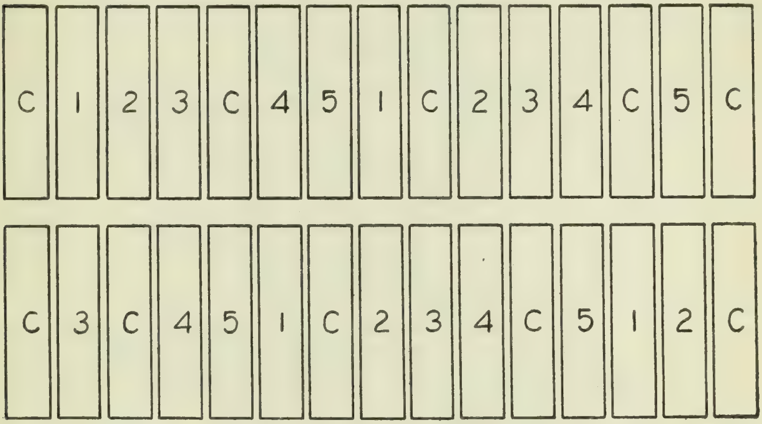
Most of these plats are one one-hundredth acre in size, having a length of 43.5 feet north and south and a breadth of 10 feet east and west. The space between plats is two feet. When the plats are planted to small grain the intervening space contains two rows of the grain drill, which are removed before harvest. When the plats are planted to corn one row of corn occupies the two-foot space, and this row is removed before harvest. This use of the space between plats prevents the larger growth along the edges of the plats and also prevents the roots of plants on one plat from feeding in another plat. There is also a one-foot margin on the edge of each plat adjacent to the roadways.

Any set of plats used for an experiment has check plats interspersed at every third or fourth plat. All check plats in any experiment receive the same treatment. Test plats are usually in four duplicates; that is, each treatment is repeated four times. The plats used in any experiment are arranged in two rows, with a roadway between the rows. Check plats occupy both ends of the space used for the experiment, but when check plats occur at every fourth plat the other check plats are not opposite each other in the rows. When check plats occur at every third plat they are opposite each other. Test plats having the same treatment are not usually placed opposite each other, but are distributed in such a way as to obtain a maximum dispersion. The accompanying diagram shows the usual arrangement of check and test plats. The nature of the experiment sometimes necessitates a modification of this arrangement.

The field is now partly tile-drained. The main drains, which are composed of four- or six-inch tiles, follow the roadways. The laterals, of three-inch tile, are laid between alternate plats, making a distance of twenty-four feet between laterals. By this arrangement all plats receive the same drainage.

In the roadways at the east and west ends of the sections concrete monuments are buried in order to mark the line of plats, and from these the location of each plat may be determined. The monuments are three feet high, eighteen inches square at the base, and six inches square at the top.

Each plat is numbered by a stake on the northeast or the southeast corner. No two plats have the same number. From the following descriptions the treatment of any plat may be ascertained.



C	1	2	3	C	4	5	1	C	2	3	4	C	5	C
C	3	C	4	5	1	C	2	3	4	C	5	1	2	C

Arrangement of plats for a series of five tests. C indicates check plats; numerals indicate test plats. Each test is repeated on the plats bearing the same numbers, making four duplicate plats

Section I, block 2, plats 711 to 732

Timothy, which was seeded in the autumn of 1910, was growing on these plats in 1912. From 1908 to 1910 inclusive the plats were planted successively to corn, oats, and wheat. From 1905 to 1907 inclusive they were in timothy and received the applications of fertilizers and farm manure shown in the following statement. These plats constitute an experiment to ascertain the effect of certain fertilizers and of manure on the yields of crops in a rotation of corn, oats, wheat, each one year, and timothy hay three years, when the grass is fertilized each year and the grain crops receive no fertilizer. A somewhat similar experiment is being conducted on section VIII, block 3, plats 7401 to 7441 and 7601 to 7639, with timothy and clover as the grass crop.

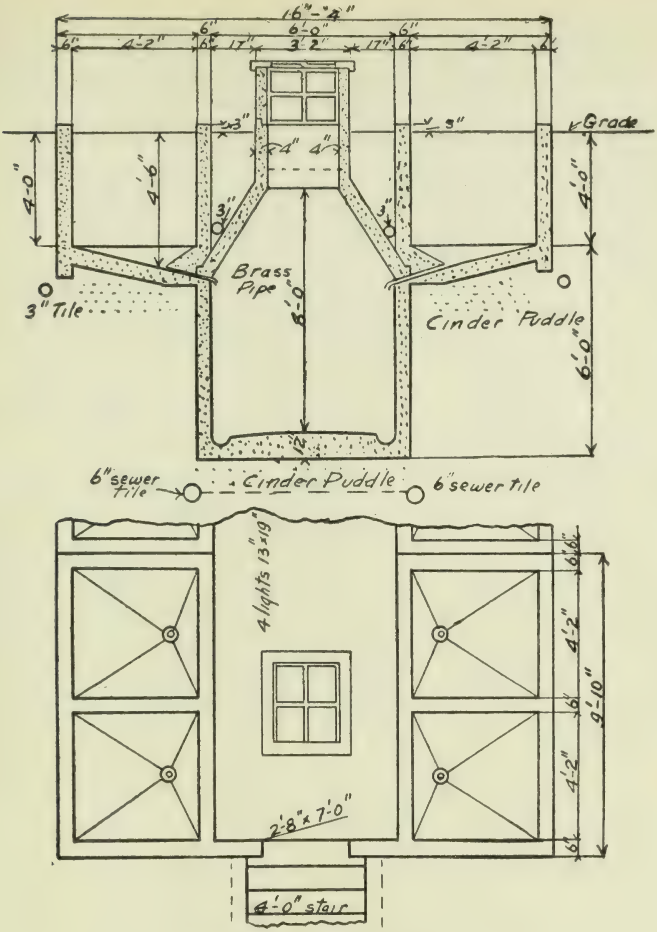
FERTILIZERS APPLIED EACH YEAR TO THE TIMOTHY

Plat	Fertilizer (quantities per acre)
711	No fertilizer
712	320 pounds acid phosphate
713	80 pounds muriate of potash
714	No fertilizer
715	160 pounds nitrate of soda
716	320 pounds acid phosphate, 160 pounds nitrate of soda
717	No fertilizer
718	320 pounds acid phosphate, 80 pounds muriate of potash
719	80 pounds muriate of potash, 160 pounds nitrate of soda
720	No fertilizer
721	320 pounds acid phosphate, 80 pounds muriate of potash, 160 pounds nitrate of soda
722	640 pounds acid phosphate, 80 pounds muriate of potash, 160 pounds nitrate of soda
723	No fertilizer
724	640 pounds acid phosphate, 80 pounds muriate of potash, 320 pounds nitrate of soda
725	320 pounds acid phosphate, 80 pounds muriate of potash, 320 pounds nitrate of soda
726	No fertilizer
727	320 pounds acid phosphate, 80 pounds muriate of potash, 320 pounds nitrate of soda
728	320 pounds acid phosphate, 80 pounds muriate of potash, 640 pounds nitrate of soda
729	No fertilizer
730	No fertilizer
731	10 tons farm manure, 1905, 1907, 1911, and in fall of 1912
732	20 tons farm manure, 1905, 1907, 1911, and in fall of 1912

Section I, block 3

Tanks for soil investigations

These are designed for the study of certain problems in soil productiveness that can be conducted only where it is possible to measure accurately certain conditions as they exist in the field, and to maintain the records through a great number of years.



Soil experiment tanks

The construction is of concrete and the tanks are lined with asphalt. Each tank is four feet and two inches square, with a maximum depth of four feet and six inches and a minimum depth of four feet. The capacity of a tank is about three and one half tons of soil. There are twenty-four tanks, placed in two rows of twelve tanks each. Between the rows of tanks is a tunnel, the bottom of which is ten feet below the tops of the tanks. The tunnel is six feet wide. From the lowest point in each tank is a heavy brass outlet tube, two inches in diameter and tin-lined. It is made large enough for easy cleaning and has no bends. A piston runs through the tube to within four inches of the upper end. The head of the piston is a perforated cone, between which and the bottom of the tank is placed fine gravel. The piston may be withdrawn if it is desired to clean the tube.

Drainage water from each tank is caught in a receptacle in the tunnel. A record is kept of the total flow from each tank, and analyses are made twice yearly of an aliquot part of the total drainage. The following substances in the drainage water are determined: (1) total solids; (2) nitrates; (3) bicarbonates; (4) carbonates; (5) silica; (6) phosphates; (7) calcium; (8) magnesium; (9) potassium; (10) sodium.

A constant water table at any desired depth may be maintained in a tank by raising the rubber tube leading from the outlet to a corresponding point below the surface of the soil in the tank.

Before the soil was placed in the tanks the surfaces were covered with a waterproof asphalt, and in order to protect the asphalt the above-ground parts of the tank walls were covered with galvanized iron sheets.

In the process of filling, the funnel-shaped bottom was first filled with sand. The soil from the fourth foot in depth as the soil lay in the field was then placed in a corresponding position in the tank, after having been carefully weighed and the moisture determined in order that the weight of dry soil might be known. The third foot of soil was then installed, and later the second foot and the surface foot, each being weighed. The soil was thoroughly packed as it was placed in the tanks and the shrinkage has been very slight. Tanks 1 to 12 are filled with Dunkirk clay loam soil. Tanks 13 to 16 contain Volusia silt loam. The remaining eight tanks are just being started.

The treatment given the soil in each tank for each year since they were filled is as follows:

TREATMENT OF SOIL TANKS SINCE THEY WERE FILLED

Tank	1910		1911		1912		1913	
	Fertilizer (quantities per acre)	Crop	Fertilizer (quantities per acre)	Crop	Fertilizer (quantities per acre)	Crop	Fertilizer (quantities per acre)	Crop
1	10 tons manure	Corn	None	Oats	None	Wheat	None	Timothy
2	10 tons manure	None	None	None	None	None	None	None
3	10 tons manure	Corn	None	Oats	None	Wheat	None	Timothy
4	10 tons manure	None	None	None	None	None	None	None
5	10 tons manure	Corn	None	Oats	None	Wheat	None	Timothy and clover
6	10 tons manure	Oats	None	Mixed grasses	None	Mixed grasses	None	Mixed grasses
7	10 tons manure, 3,000 pounds lime	Corn	None	Oats	None	Wheat	None	Timothy
8	10 tons manure, 3,000 pounds lime	None	None	None	None	None	None	None
9	10 tons manure, 3,000 pounds lime	Corn	None	Oats	None	Wheat	None	Timothy and clover
10	10 tons manure, 3,000 pounds lime	Oats	None	Mixed grasses	None	Mixed grasses	None	Mixed grasses
11	10 tons manure, 200 pounds potassium sulfate	Corn	200 pounds potassium sulfate	Oats	200 pounds potassium sulfate	Wheat	200 pounds potassium sulfate	Timothy
12	10 tons manure, 3,000 pounds lime, 200 pounds potassium sulfate	Corn	200 pounds potassium sulfate	Oats	200 pounds potassium sulfate	Wheat	200 pounds potassium sulfate	Timothy
13	Being filled	....	None	None	None	None	10 tons manure	Oats
14	Being filled	....	None	None	None	None	10 tons manure	None
15	Being filled	....	None	None	None	None	10 tons manure, 3,000 pounds lime	Oats
16	Being filled	....	None	None	None	None	10 tons manure, 3,000 pounds lime	None

Section I, block 4, plats 741 to 750

These plats were originally designed for testing the effect of different methods of soil inoculation and of fertilizer and lime treatment in obtaining a stand of alfalfa and on its later growth. The alfalfa was seeded in 1905. The effects of the different methods of inoculation and of the fertilizers were never strongly apparent, but the experiment gave a striking illustration of the beneficial effect of lime on this soil when applied to alfalfa land. The north halves of all the plats were limed at the rate of two thousand pounds per acre.

These plats were plowed up and planted to corn in 1912 and are now (1913) in oats, which gives an opportunity to compare the growth of oats on limed alfalfa land with the growth on unlimed alfalfa land.

The original treatment of these plats was as follows:

Plat	Treatment (quantities per acre)
741	No treatment
742	20 tons stable manure
743	400 pounds inoculated soil
744	No treatment
745	20 tons manure, 400 pounds inoculated soil
746	640 pounds nitrate of soda on south half, and inoculated soil
747	No treatment
748	20 tons manure, and inoculated seed
749	130 pounds nitrate of soda, 330 pounds acid phosphate, 40 pounds muriate of potash
750	No treatment

The north halves of all plats were limed at the rate of one ton per acre.

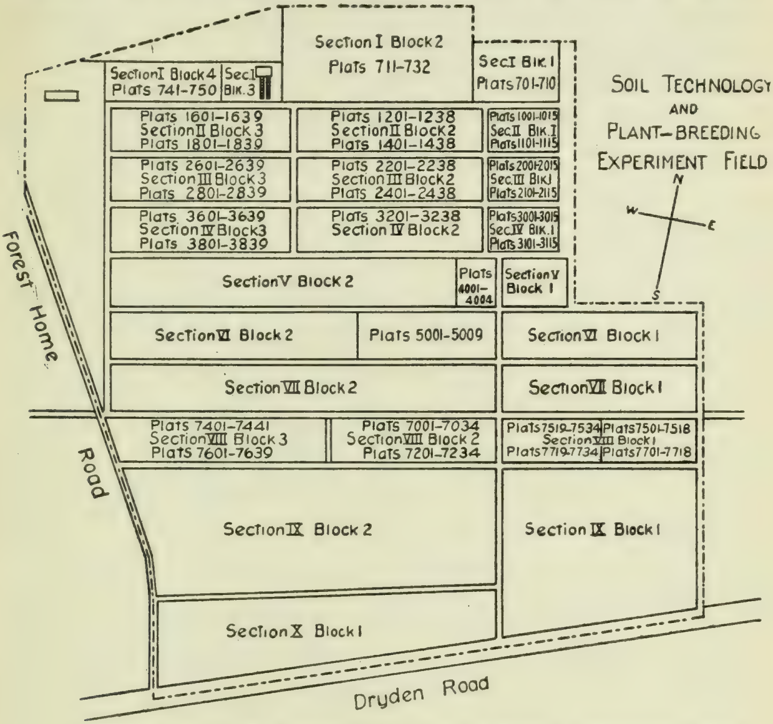
Section II, block 1, plats 1001 to 1015, 1101 to 1115

These are all small plats of one one-hundredth-acre area, being 43.5 feet north and south and 10 feet east and west, with a two-foot space between the plats. They were laid out in 1911, and all were planted to corn in that year for the purpose of ascertaining the degree of uniformity of their productiveness and their suitability for purposes of experimentation.

In the autumn of 1911 the plats were all tile-drained. In 1912 they were drilled to oats in order to continue the test of uniformity. This year (1913) they are again in oats, but they have been fertilized in order to determine whether the addition of a fertilizer changes materially their relative productiveness.

Section II, block 2, plats 1201 to 1238, 1401 to 1438

Certain plats of this block are seeded to alfalfa and others to timothy.



Caldwell Field. Soil technology and plant-breeding experiment field

It is intended to determine the nitrogen balance in the soil under these crops at the end of a period of five or ten years, when fertilizers, manure, and lime have been added to the soil, when they have not, and when the hay crops have been regularly removed. This should lead to a knowledge of the amount of nitrogen fixation that may be expected in soil growing these crops, and of the conditions of treatment that are favorable to such fixation. While other soils probably differ from this in respect to nitrogen fixation under similar treatments, yet the accumulation of definite data on this subject is desirable in view of the little knowledge that is available at present. Each plat has been sampled by eighteen borings, and determinations of nitrogen have been made. The different systems of top-dressing will also give information on the use of certain fertilizers for that purpose on land continuously in these crops.

The plat treatments will be as follows:

Plats	Crop	Soil treatment (quantities per acre)
1201, 1204, 1207 1222, 1225, 1228 1403, 1406, 1409 1420, 1423, 1426	Alfalfa	Lime, no fertilizer
1202, 1227, 1405, 1424	Alfalfa	Lime, 5 tons farm manure, biennially
1203, 1226, 1407, 1422	Alfalfa	Lime, 100 pounds acid phosphate, annually
1205, 1224, 1408, 1421	Alfalfa	Lime, 300 pounds acid phosphate, 50 pounds muriate of potash, annually
1206, 1223, 1404, 1425	Alfalfa	Lime, 300 pounds acid phosphate, annually
1209, 1220, 1401, 1428	Alfalfa	No lime, no fertilizer
1208, 1221, 1402, 1427	Alfalfa	No lime, 300 pounds acid phosphate, 50 pounds muriate of potash, annually
1210, 1213, 1216 1232, 1235, 1238 1413, 1416, 1419 1429, 1432, 1435	Timothy	Lime, no fertilizer
1211, 1237, 1414, 1434	Timothy	Lime, 200 pounds nitrate of soda, 100 pounds acid phosphate, 50 pounds muriate of potash, annually
1212, 1236, 1415, 1433	Timothy	Lime, 400 pounds nitrate of soda, 100 pounds acid phosphate, 50 pounds muriate of potash, annually
1214, 1234, 1417, 1431	Timothy	Lime, 5 tons farm manure, biennially
1215, 1233, 1418, 1430	Timothy	Lime, 400 pounds nitrate of soda, 300 pounds acid phosphate, 50 pounds muriate of potash, annually

Plats	Crop	Soil treatment (quantities per acre)
1217, 1219, 1229, 1231 1410, 1412, 1436, 1438 ..	Timothy..	No lime, no fertilizer
1218, 1230, 1411, 1437....	Timothy..	No lime, 400 pounds nitrate of soda, 300 pounds acid phosphate, 50 pounds muriate of potash, annually

On these plats lime is applied uniformly at the rate of 8000 pounds of ground limestone per acre wherever its use is indicated. The limestone is ground sufficiently fine to pass a fifty-mesh sieve.

Section II, block 3, plats 1601 to 1639, 1801 to 1839

On these plats a test is being made of the effect of acid phosphate and of ground rock phosphate on the yields of certain crops, when these fertilizers are used with rather heavy applications of farm manure and when they are used with only mineral fertilizers — as, for example, nitrate of soda and muriate of potash. It is particularly desired to ascertain whether the incorporation of farm manure increases the effectiveness of the raw phosphate.

A six-years rotation is in progress, of which the courses are corn, oats, wheat, each one year, and hay three years. Plats receiving the floats, or raw phosphate, have a three-years supply of floats applied before being seeded to grass. The grain crops receive floats annually. Acid phosphate is applied annually in the quantities designated in the outline. Farm manure will be applied to the grass and the corn at the rate of 15 tons per acre. When minerals are designated in the outline, the quantities are 300 pounds of nitrate of soda and 50 pounds of muriate of potash per acre for the grass crops, and 100 pounds and 50 pounds, respectively, of these constituents for the grain crops.

The seeding in the fall of 1913 was done without a nurse crop. The comparison in the first year is between acid phosphate and floats, minerals being applied to all plats in order to encourage the growth of hay.

OUTLINE FOR TREATMENT OF PLATS 1601 TO 1639, 1801 TO 1839

Plat	Fertilizer (quantities per acre)	Plat	Fertilizer (quantities per acre)
1601	No fertilizer	1607	No fertilizer
1602	Manure	1608	Minerals, 200 pounds acid phosphate
1603	Manure, 100 pounds acid phosphate	1609	Minerals alone
1604	No fertilizer	1610	No fertilizer
1605	Minerals, 100 pounds acid phosphate	1611	Manure, 200 pounds floats
1606	Manure, 200 pounds acid phosphate	1612	Manure, 400 pounds floats

OUTLINE FOR TREATMENT OF PLATS 1601 TO 1639, 1801 TO 1839 (*continued*)

Plat	Fertilizer (quantities per acre)	Plat	Fertilizer (quantities per acre)
1613	No fertilizer	1807	No fertilizer
1614	Minerals, 400 pounds floats	1808	Minerals, 2,400 pounds floats
1615	Manure, 800 pounds floats	1809	Manure
1616	No fertilizer	1810	No fertilizer
1617	Manure, 2,400 pounds floats	1811	Manure, 100 pounds acid phosphate
1618	Minerals, 2,400 pounds floats	1812	Minerals, 100 pounds acid phosphate
1619	No fertilizer	1813	No fertilizer
1620	Manure	1814	Manure, 200 pounds acid phosphate
1621	Manure, 100 pounds acid phosphate	1815	Minerals, 200 pounds acid phosphate
1622	No fertilizer	1816	No fertilizer
1623	Minerals, 100 pounds acid phosphate	1817	Minerals alone
1624	Manure, 200 pounds acid phosphate	1818	Manure, 200 pounds floats
1625	No fertilizer	1819	No fertilizer
1626	Minerals, 200 pounds acid phosphate	1820	Manure, 400 pounds floats
1627	Minerals alone	1821	Minerals, 400 pounds floats
1628	No fertilizer	1822	No fertilizer
1629	Manure, 200 pounds floats	1823	Manure, 800 pounds floats
1630	Manure, 400 pounds floats	1824	Manure, 2,400 pounds floats
1631	No fertilizer	1825	No fertilizer
1632	Minerals, 400 pounds floats	1826	Minerals, 2,400 pounds floats
1633	Manure, 800 pounds floats	1827	Manure
1634	No fertilizer	1828	No fertilizer
1635	Manure, 400 pounds acid phosphate	1829	Manure, 400 pounds acid phosphate
1636	No fertilizer	1830	No fertilizer
1637	Manure, 2,400 pounds floats	1831	Manure, 100 pounds acid phosphate
1638	Minerals, 2,400 pounds floats	1832	Minerals, 100 pounds acid phosphate
1639	No fertilizer	1833	No fertilizer
1801	No fertilizer	1834	Manure, 200 pounds acid phosphate
1802	Manure, 400 pounds floats	1835	Minerals, 200 pounds acid phosphate
1803	Minerals, 400 pounds floats	1836	No fertilizer
1804	No fertilizer	1837	Minerals alone
1805	Manure, 800 pounds floats	1838	Manure, 200 pounds floats
1806	Manure, 2,400 pounds floats	1839	No fertilizer

Section III, block 1, plats 2001 to 2015, 2101 to 2115

These plats are occupied by an experiment designed to ascertain the effect on the productivity of this soil of continuous cropping without the replacing of any of the mineral nutrients removed by the crop. It is intended, however, to maintain a liberal quantity of organic matter in the soil by means of grass or legumes. Thus, a series of five plats will each year have three plats in timothy, one plat in corn, and one in oats seeded with timothy; the next year the corn plat will be seeded and one of the timothy plats will be planted to corn. The seeding is done with oats. In this way each plat will be in timothy three years, corn one year, and oats and timothy one year. In another series the seeded crop is alfalfa, and in yet another series it is timothy and clover. Each series is duplicated.

The feature in which this experiment differs from continuous-cropping experiments as generally conducted, is in the maintenance of the supply of organic matter without the addition of any mineral nutrients.

CONTINUOUS CROPPING WITHOUT MANURES

Plat	1911	1912	1913	1914	1915	1916
2001, 2006	Corn	Oats and alfalfa	Alfalfa	Alfalfa	Alfalfa	Corn
2002, 2007	Alfalfa	Corn	Oats and alfalfa	Alfalfa	Alfalfa	Alfalfa
2003, 2008	Alfalfa	Alfalfa	Corn	Oats and alfalfa	Alfalfa	Alfalfa
2004, 2009	Alfalfa	Alfalfa	Alfalfa	Corn	Oats and alfalfa	Alfalfa
2005, 2010	Alfalfa	Alfalfa	Alfalfa	Alfalfa	Corn	Oats and alfalfa
2011, 2101	Corn	Oats and timothy	Timothy	Timothy	Timothy	Corn
2012, 2102	Timothy	Corn	Oats and timothy	Timothy	Timothy	Timothy
2013, 2103	Timothy	Timothy	Corn	Oats and timothy	Timothy	Timothy
2014, 2104	Timothy	Timothy	Timothy	Corn	Oats and timothy	Timothy
2015, 2105	Timothy	Timothy	Timothy	Timothy	Corn	Oats and timothy
2106, 2111	Corn	Oats, timothy, and clover	Timothy and clover	Timothy and clover	Timothy and clover	Corn
2107, 2112	Timothy and clover	Corn	Oats, timothy, and clover	Timothy and clover	Timothy and clover	Timothy and clover
2108, 2113	Timothy and clover	Timothy and clover	Corn	Oats, timothy, and clover	Timothy and clover	Timothy and clover
2109, 2114	Timothy and clover	Timothy and clover	Timothy and clover	Corn	Oats, timothy, and clover	Timothy and clover
2110, 2115	Timothy and clover	Timothy and clover	Timothy and clover	Timothy and clover	Corn	Oats, timothy, and clover

Section III, block 2, plats 2201 to 2226, 2401 to 2426

In these plats an attempt is made to ascertain the influence of certain crops on the formation of nitrates in soil during the year following the growth of the plants. Corn, potatoes, oats, wheat, and rye were grown for two years consecutively. In 1913 these plats were left bare. Nitrates were determined in the soil from time to time during the early part of the summer.

Section IV, block 2, plats 3204 to 3238, 3411 to 3438

A test of different chemical forms of lime and of different degrees of fineness of ground limestone is being made on these plats. The applications were made in the spring of 1911 and sorghum was planted in that year. No applications have since been made, except to the plats receiving five hundred pounds of caustic lime biennially. Oats were grown in 1912 and wheat was planted in the fall of that year.

Plat	Applications of lime (quantities per acre)	Units of lime per year
3205, 3208	5,700 pounds limestone, 50-mesh, 500 pounds gypsum	3
3207, 3210	500 pounds gypsum	⅙
3211, 3223, 3420, 3432	1,600 pounds solvay lime	1
3212, 3224, 3416, 3428	1,975 pounds marl	1
3214, 3226, 3418, 3430	6,000 pounds limestone, 50-mesh	3
3215, 3227, 3422, 3434	3,000 pounds caustic lime	3
3216, 3228, 3421, 3433	500 pounds caustic lime, biennially	¼
3218, 3230, 3414, 3426	1,000 pounds caustic lime	1
3219, 3231, 3412, 3424	1,800 pounds limestone, 200-mesh	1
3220, 3232, 3413, 3425	2,000 pounds limestone, 50-mesh	1
3222, 3234, 3417, 3429	1,850 pounds limestone, 10-mesh	1
3236	3,250 pounds dolomite	1
3437	2,000 pounds dolomite	⅔
3237, 3436	1,333 pounds magnesite	....
3204, 3206, 3209, 3213 3217, 3221, 3225, 3229 3233, 3235, 3238, 3411 3415, 3419, 3423, 3427 3431, 3435, 3438	No treatment	....

Section V, block 1, plats 4501 to 4513, 4701 to 4713

It is intended to test on these plats three high-grade nitrogen-carriers, namely, sodium nitrate, ammonium sulfate, and calcium cyanamid. The last of these is of recent invention, but is now being manufactured extensively in Europe and to some extent in this country. Ammonium sulfate has a rapidly increasing output. The well-known sodium nitrate, which is a product of nature, must some day cease to furnish a supply of nitrogen.

The value of nitrate of soda applied to timothy on this soil has been well demonstrated. It is now intended to test these other carriers of nitrogen in comparison with nitrate of soda in a rotation, and particularly on timothy hay.

Each plat received 200 pounds of acid phosphate and 40 pounds of muriate of potash per acre. Nitrogen will be added at the rate of 9 pounds per acre for corn and oats and 15 pounds per acre for timothy. The quantities of nitrogen applied per acre in 1913 are as follows:

Plat	Nitrogen applied (quantities per acre)	Plat	Nitrogen applied (quantities per acre)
4501	9 pounds in sodium nitrate	4701	9 pounds in sodium nitrate
4502	3 pounds in sodium nitrate	4702	9 pounds in calcium cyanamid
	6 pounds in calcium cyanamid	4703	9 pounds in ammonium sulfate
4503	3 pounds in sodium nitrate	4704	9 pounds in sodium nitrate
	6 pounds in ammonium sulfate	4705	3 pounds in sodium nitrate
4504	9 pounds in sodium nitrate		6 pounds in calcium cyanamid
4505	9 pounds in calcium cyanamid	4706	3 pounds in sodium nitrate
4506	9 pounds in ammonium sulfate		6 pounds in ammonium sulfate
4507	9 pounds in sodium nitrate	4707	9 pounds in sodium nitrate
4508	9 pounds in ammonium sulfate	4708	3 pounds in sodium nitrate
4509	9 pounds in calcium cyanamid		6 pounds in calcium cyanamid
4510	9 pounds in sodium nitrate	4709	3 pounds in sodium nitrate
4511	3 pounds in sodium nitrate		6 pounds in ammonium sulfate
	6 pounds in ammonium sulfate	4710	9 pounds in sodium nitrate
4512	3 pounds in sodium nitrate	4711	9 pounds in calcium cyanamid
	6 pounds in calcium cyanamid	4712	9 pounds in ammonium sulfate
4513	9 pounds in sodium nitrate	4713	9 pounds in sodium nitrate

Section VI, block 2, plats 5001 to 5009

The object of this experiment is to ascertain the possibility of improving, with top-dressings of manure, a field of alfalfa that has begun to deteriorate. The check plats received no fertilizer nor manure.

Plat	Fertilizer (quantities per acre)
5001	Check
5002	5 tons farm manure
5003	100 pounds acid phosphate
5004	100 pounds acid phosphate, 16 pounds muriate of potash
5005	Check
5006	5 tons manure
5007	100 pounds acid phosphate
5008	100 pounds acid phosphate, 16 pounds muriate of potash
5009	Check

Farm manure was first applied in 1911 and has not since been used. Acid phosphate and muriate of potash have been applied once in each of the years 1911, 1912, and 1913. The stand was almost completely destroyed in the winter of 1913.

Section VIII, block 1, plats 7501 to 7518, 7701 to 7718

In seeding timothy with a nurse crop the success of the catch of grass often depends on the growth of the nurse crop, a luxuriant growth of the latter sometimes smothering the grass. It is a question, therefore, whether the nurse crop should receive fertilizer manure. Does the increased growth of the nurse crop counterbalance the benefit that the grass crop may receive from the fertilizer? Would it be better to apply the fertilizer to the seeding immediately after the nurse crop is removed? Is the stand and growth of timothy better after the second year if the crop is seeded with clover than if it is seeded without clover? In this experiment the check plats received no fertilizer. The fertilizer constituents, when used at all, were applied at the rate of 100 pounds of acid phosphate, 16 pounds of muriate of potash, and 24 pounds of nitrate of soda per acre. The manured plats received 10 tons of mixed farm manure per acre. The plats were seeded in the fall of 1911.

Plat	Treatment	Plat	Treatment
7501	Rye, timothy; no fertilizer	7701	Rye, timothy; no fertilizer
7502	Rye, timothy; phosphate and muriate in fall; clover in spring	7702	Rye, timothy; phosphate and muriate in fall, nitrate in spring
7503	Rye, timothy; no fertilizer; clover in spring	7703	Rye, timothy; phosphate and muriate in fall, nitrate after cutting rye
7504	Rye, timothy; manure in fall; clover in spring	7704	Rye, timothy; no fertilizer
7505	No rye, timothy; nitrate in fall; clover in spring	7705	No rye, timothy; nitrate in fall
7506	No rye, timothy; nitrate in fall	7706	No rye; timothy; nitrate in fall; clover in spring
7507	Rye, timothy; phosphate and muriate in fall, nitrate after cutting rye	7707	Rye, timothy; phosphate and muriate in fall; clover in spring
7508	Rye, timothy; no fertilizer	7708	Rye, timothy; clover in spring
7509	Rye, timothy; phosphate and muriate in fall, nitrate in spring	7709	Rye, timothy; manure in fall; clover in spring
7510	No rye, timothy; nitrate in fall	7710	No rye, timothy; nitrate in fall; clover in spring
7511	Rye, timothy; phosphate and muriate in fall, nitrate after cutting rye	7711	Rye, timothy; phosphate and muriate in fall; clover in spring
7512	Rye, timothy; phosphate and muriate in fall, nitrate in spring	7712	Rye, timothy; no fertilizer
7513	Rye, timothy; clover in spring	7713	Rye, timothy; clover in spring
7514	Rye, timothy; clover in spring	7714	Rye, timothy; manure in fall; clover in spring
7515	Rye, timothy; no fertilizer	7715	Rye, timothy; phosphate and muriate in fall, nitrate in spring
7516	No rye, timothy; nitrate in fall; clover in spring	7716	No rye, timothy; nitrate in fall
7517	Rye, timothy; manure in fall; clover in spring	7717	Rye, timothy, phosphate and muriate in fall, nitrate after cutting rye
7518	Rye, timothy; no fertilizer	7718	Rye, timothy; no fertilizer

Section VIII, block 1, plats 7519 to 7534, 7719 to 7734

This is essentially a repetition of the previous experiment except that the seeding was done with oats instead of rye as a nurse crop, the oats being seeded in the spring of 1913. The fertilizers and the farm manure were added at the same rate as above. The treatments are as follows:

Plat	Treatment	Plat	Treatment
7519	Timothy; no fertilizer	7719	Timothy; no fertilizer
7520	Timothy and clover; nitrate, phosphate, and potash in spring	7720	Timothy; nitrate, phosphate, and potash in spring
7521	Timothy and clover; no fertilizer	7721	Timothy; nitrate after oats
7522	Timothy; nitrate, phosphate, and potash in spring, nitrate after oats	7722	Timothy; phosphate and potash in spring, nitrate after oats
7523	Timothy; nitrate, phosphate, and potash in spring	7723	Timothy and clover; nitrate, phosphate, and potash in spring
7524	Timothy; no fertilizer	7724	Timothy; no fertilizer
7525	Timothy; nitrate after oats	7725	Timothy and clover; no fertilizer
7526	Timothy; phosphate and potash in spring, nitrate after oats	7726	Timothy; nitrate, phosphate, and potash in spring, nitrate after oats
7527	Timothy; nitrate after oats	7727	Timothy and clover; nitrate, phosphate, and potash in spring
7528	Timothy; phosphate and potash in spring, nitrate after oats	7728	Timothy and clover; no fertilizer
7529	Timothy; no fertilizer	7729	Timothy; no fertilizer
7530	Timothy; nitrate, phosphate, and potash in spring, nitrate after oats	7730	Timothy; nitrate after oats
7531	Timothy; nitrate, phosphate, and potash in spring	7731	Timothy; phosphate and potash, nitrate after oats
7532	Timothy and clover; nitrate, phosphate, and potash in spring	7732	Timothy; nitrate, phosphate, and potash in spring, nitrate after oats
7533	Timothy and clover; no fertilizer	7733	Timothy; nitrate, phosphate, and potash in spring
7534	Timothy; no fertilizer	7734	Timothy; no fertilizer

Section VIII, block 2, plats 7001 to 7016, 7201 to 7216

Experiments conducted in the soil tanks in section 1, block 3, are being repeated on these plats for the purpose of subjecting the tank experiments to field conditions. Check plats are interposed between each two test plats. The checks have received no lime nor special fertilizer, but they are manured in the same quantities as are all the test plats. The soils of these plats have been sampled to a depth of four feet, samples from each foot being kept separate. It is intended to ascertain by this means the changes in soil composition that accompany the loss of certain constituents in the drainage water during a period of many years. The plats were laid out in 1910, and the treatments for the purpose of the experiment, as well as the crops grown, are entirely similar to the corresponding tanks as shown below:

Plat	Treatment in 1910	Tanks
7001, 7201	Check	....
7002, 7202	No lime	1 and 3
7003, 7203	No lime	2 and 4
7004, 7204	Check	....
7005, 7205	No lime	5
7006, 7206	No lime	6
7007, 7207	Check	....
7008, 7208	Lime	7
7009, 7209	Lime	8
7010, 7210	Check	....
7011, 7211	Lime	9
7012, 7212	Lime	10
7013, 7213	Check	....
7014, 7214	Potassium sulfate, annually	11
7015, 7215	Lime potassium sulfate, annually	12
7016, 7216	Check	....

*Section VIII, block 3, plats 7401 to 7441, 7601 to 7639**

The experiment for which these plats are utilized is supplementary to those on plats 711 to 732, and consists of a comparison of the practice of manuring the hay crops in a rotation of timothy and clover three years, corn, oats, and wheat each one year, with the system of manuring the grain crops in such a rotation. As the previously mentioned experiments indicated that the wheat crop suffered for plant-food when only the grass was fertilized, some of the plats in this experiment have both the grass crops and the wheat fertilized. It will be noticed on the plan given below that large and small quantities of fertilizer are used; also, that acid phosphate is being compared with ground raw phosphate rock, equivalent quantities of phosphorus being used in the two forms, and on other plats approximately equivalent money values of these two forms of phosphorus are being compared.

The experiment was started in 1911, at which time timothy and clover were seeded with barley, which was used instead of wheat. Wheat would have been used in the rotation but for the fact that the experiment was begun in spring and wheat could not well be employed. On those plats that were to be fertilized for wheat the fertilizer was applied to the barley, so as to obtain the effect of the residual fertilizers on the hay crop in 1912.

The application of manures for the entire rotation is as follows:

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*Plats 7439 and 7440 were not used in the experiment.

Plat	1911	1912	1913	1914	1915	1916	1917
	Barley	Hay	Hay	Hay	Corn	Oats	Wheat
7402, 7420 7612, 7630		92 pounds nitrate 128 pounds phosphate	68 pounds nitrate 128 pounds phosphate	128 pounds nitrate 128 pounds phosphate	No fertilizer	No fertilizer	No fertilizer
7403, 7422 7613, 7632	24 pounds nitrate 100 pounds phosphate	No fertilizer	No fertilizer	No fertilizer	184 pounds phosphate	24 pounds nitrate 100 pounds phosphate	24 pounds nitrate 100 pounds phosphate
7404, 7423 7614, 7633	24 pounds nitrate 100 pounds phosphate 16 pounds muriate	No fertilizer	No fertilizer	No fertilizer	184 pounds phosphate 24 pounds muriate	24 pounds nitrate 100 pounds phosphate 16 pounds muriate	24 pounds nitrate 100 pounds phosphate 76 pounds muriate
7406, 7424 7616, 7634	192 pounds nitrate 100 pounds phosphate 56 pounds muriate	No fertilizer	No fertilizer	No fertilizer	184 pounds phosphate 56 pounds muriate	96 pounds nitrate 100 pounds phosphate 56 pounds muriate	192 pounds nitrate 100 pounds phosphate 56 pounds muriate
7407, 7426 7617, 7636	No fertilizer	92 pounds nitrate 128 pounds phosphate 56 pounds muriate	68 pounds nitrate 128 pounds phosphate 56 pounds muriate	128 pounds nitrate 128 pounds phosphate 56 pounds muriate	No fertilizer	No fertilizer	No fertilizer
7408, 7427 7618, 7637	96 pounds nitrate 128 pounds phosphate 56 pounds muriate	92 pounds nitrate 128 pounds phosphate 56 pounds muriate	68 pounds nitrate 128 pounds phosphate 56 pounds muriate	128 pounds nitrate 128 pounds phosphate 56 pounds muriate	No fertilizer	No fertilizer	96 pounds nitrate 128 pounds phosphate 56 pounds muriate

Plat	1911	1912	1913	1914	1915	1916	1917
	Barley	Hay	Hay	Hay	Corn	Oats	Wheat
7410, 7428 7620, 7638	No fertilizer	92 pounds nitrate 256 pounds floats 56 pounds muriate	68 pounds nitrate 256 pounds floats 56 pounds muriate	128 pounds nitrate 64 pounds floats 56 pounds muriate	No fertilizer		
7411, 7430 7621, 7602	No fertilizer	92 pounds nitrate 64 pounds floats 56 pounds muriate	68 pounds nitrate 64 pounds floats 56 pounds muriate	128 pounds nitrate 64 pounds floats 56 pounds muriate	No fertilizer		
7412, 7431 7622, 7604	No fertilizer	276 pounds nitrate 384 pounds phosphate 168 pounds muriate	204 pounds nitrate 384 pounds phosphate 168 pounds muriate	384 pounds nitrate 384 pounds phosphate 168 pounds muriate	No fertilizer		
7414, 7432 7624, 7605	No fertilizer	10 tons farm manure	10 tons farm manure	10 tons farm manure	No fertilizer		
7415, 7434 7625, 7606	24 pounds nitrate 100 pounds phosphate 16 pounds muriate	10 tons farm manure	10 tons farm manure	10 tons farm manure	No fertilizer		24 pounds nitrate 100 pounds phosphate 16 pounds muriate
7416, 7435 7626, 7608	No fertilizer				20 tons manure	No fertilizer	10 tons manure top-dressed
7418, 7436 7628, 7609	24 pounds nitrate 100 pounds phosphate 16 pounds muriate	5 tons farm manure	5 tons farm manure	5 tons farm manure	184 pounds phosphate 24 pounds muriate	24 pounds nitrate 100 pounds phosphate 16 pounds muriate	24 pounds nitrate 100 pounds phosphate 16 pounds muriate

Plats	1911	1912	1913	1914	1915	1916	1917
	Barley	Hay	Hay	Hay	Corn	Oats	Wheat
7419, 7438 7629, 7610	24 pounds nitrate 100 pounds phosphate 16 pounds muriate	10 tons farm manure	10 tons farm manure	10 tons farm manure	184 pounds phosphate 24 pounds muriate	24 pounds nitrate 100 pounds phosphate 16 pounds muriate	24 pounds nitrate 100 pounds phosphate 16 pounds muriate
7401, 7405, 7409 7413, 7417, 7421 7425, 7429, 7433 7437, 7441 7601, 7603, 7607 7611, 7615, 7619 7623, 7627, 7631 7635, 7639	No fertilizer at any time						

Plant-breeding Experiment Plats

Timothy-breeding experiments.— The timothy-breeding experiments at the Cornell University Agricultural Experiment Station are probably the most extensive experiments in the breeding of a forage crop that have ever been conducted. These experiments were begun in 1903. Heads of timothy were obtained from a large number of places in America and in foreign countries. The seed from these heads was germinated in sterilized soil and the young plants were grown for a time in pots, after which they were planted in the field. A plat consisting of two rows of twenty-one plants each—a total of forty-two plants—was planted from each kind, or each lot, of seed, the plants being placed three feet apart each way. Plats 1 to 217 were grown from American seed and plats 218 to 298 from foreign seed. Every third plat in the two rows of each kind was planted with timothy seed from the university farm as a check, and these plats were labeled " C."

From these plats selections were made in 1904 of individuals showing interesting variations such as heavy yield, light yield, coarse stems, fine stems, early bloom, late bloom. Plants were grown from open fertilized seed of these selections and were planted in the field in 1905, in plats of two rows each, with eighteen plants in each row. The plats containing these selections were numbered 801 to 947. In this case, also, every third plat was a check marked " C " and was planted with seedlings from a single good plant. Plats 948 to 969 were timothy progenies from vigorous plants and from weak plants, intended especially to throw light on the question of the transmission of these characters. In the summer of 1907, selections were made of the best plants and of those presenting interesting characters, and these were propagated vegetatively in plats 1601 to 1805. The purposes of this experiment were (1) the study of the variations, methods of breeding, and life history of timothy, and (2) the development of improved races for cultivation. All the above plats, having served their purpose, have been discontinued.

In the spring of 1908, further propagations were made of various selected types and the seedlings were planted in plats 3001 to 3220. These are in section VII, block 2. The western parts of these plats, or series of rows (plats 3001 to 3103), contain plantings of a number of types propagated by slips and form an excellent illustration of the great range of variability exhibited by different types (clonal types) of timothy. Here will be found dwarfs and giants, slender and thick individuals, long-headed and short-headed sorts, early and late types, and the like. Following these, plats 3104 to 3220 are comparison rows of inbred and open-fertilized seed, together with clonal rows from the same types. In this series of plats every eighth row is a check, C, and is planted with open-fertilized seed of a certain selected plant, No. 1606.09.

In 1909 a similar series of plats was planted with inbred seed of a number of selected individual strains. These include plats 1900 to 1972, and occupy section IV, block 1. Here, again, every eighth row is a check and is planted with plants grown from open-fertilized seed of a selected plant, No. 1611. (No. 1611 is the original type of the variety now being propagated under the name " Cornell Standard.")

Plats 1831 to 1858, in section III, block 3, planted in 1909, are broadcast plats of a number of the most promising sorts. These plats, of which there are twenty-eight, are mainly of the standard size—four rods long by one rod wide—and contain one fortieth acre each. Of these plats, eight are half this size. In this series every fourth plat is a check and is planted with good commercial seed for comparison of type and yield. All the above plats, planted in 1909, were discontinued in the fall of 1913.

Plats 1815 to 1830 in section IX, block 2, planted in 1909, are small isolated plats planted with plants from inbred seed of promising types for the purpose of obtaining pure seed for propagation purposes. These plats were later extended by further plantings of slips from selected plants of the same type. It was expected that these plats would each year be surrounded by some tall crop, such as rye, which would tend to give more thorough isolation.

Plats 3220a to 3357, in the eastern half of section VII, block 2, planted in 1910, are numbered from east to west. Plats 3220a to 3325 are propagated vegetatively as clonal varieties and are vegetative propagations of the originally selected types. On plats 3326 to 3357 plants from inbred seed of various selected types are being grown, in order to test their transmission.

Plats 1856 to 1884, in section VI, block 2 (numbered from east to west), planted in 1911, are standard one-fortieth-acre plats, four rods long and one rod wide, seeded with various promising types. Every fourth plat is a check planted with the best available ordinary timothy.

Plats 1885 to 1894, in the western part of section V, block 2 (numbered from west to east), planted in 1911, are standard one-fortieth-acre plats seeded with light and heavy seed of various new varieties. Every fourth plat is a check of good ordinary timothy.

Plats 3358 to 3387, in sections V and VI, located between the above two series of plats and planted in 1911, are a series of one-square-rod plats seeded with various interesting and promising types. Every fifth plat is a check planted with good ordinary timothy.

Plats 3393 to 3405, in the median part of section V, block 2 (numbered from west to east), planted in 1912, are one-fortieth-acre broadcast plats seeded with various promising types. Every fourth plat is a check seeded with good standard timothy.

Plats 3406 to 3423, in the median part of section V, block 2 (numbered from west to east and located south of the above series), planted in 1912, are one-eightieth-acre broadcast plats seeded with various promising or interesting types. Every fifth plat is a check seeded with good ordinary timothy.

Plats 3424 to 3436, located between the two preceding series and numbered from west to east, planted in 1912, are one-square-rod broadcast plats seeded with various promising types. Every sixth plat is a check.

Other forage-crop investigations.— *Bromus inermis* selections from individual plants are planted on plats 1973 to 1980 in section IV, block 1. These plats are vegetative reproductions of different types.

Cereal investigations.— Cereal investigations are being conducted in cooperation with the Bureau of Plant Industry of the United States Department of Agriculture.

(*a*) *Wheat investigations.*— A large number of selected strains of wheat are being grown on section VII, block 2, in comparison with commercial varieties. These are sown in test rows and are repeated several times in order to make the results more accurate. About sixty new strains, which have been obtained through selection from commercial varieties, are grown in comparison with about the same number of varieties.

About five hundred selections, which were made from different fields during 1912, are being grown in head rows.

Several of the strains that have given promise of high yield for the last several years are being grown in increase plats.

Rows of about two hundred varieties of wheat are being grown, to serve as a basis for a closer study of varieties and as foundation stock for future work. This work is planned primarily to develop better-yielding varieties for New York State.

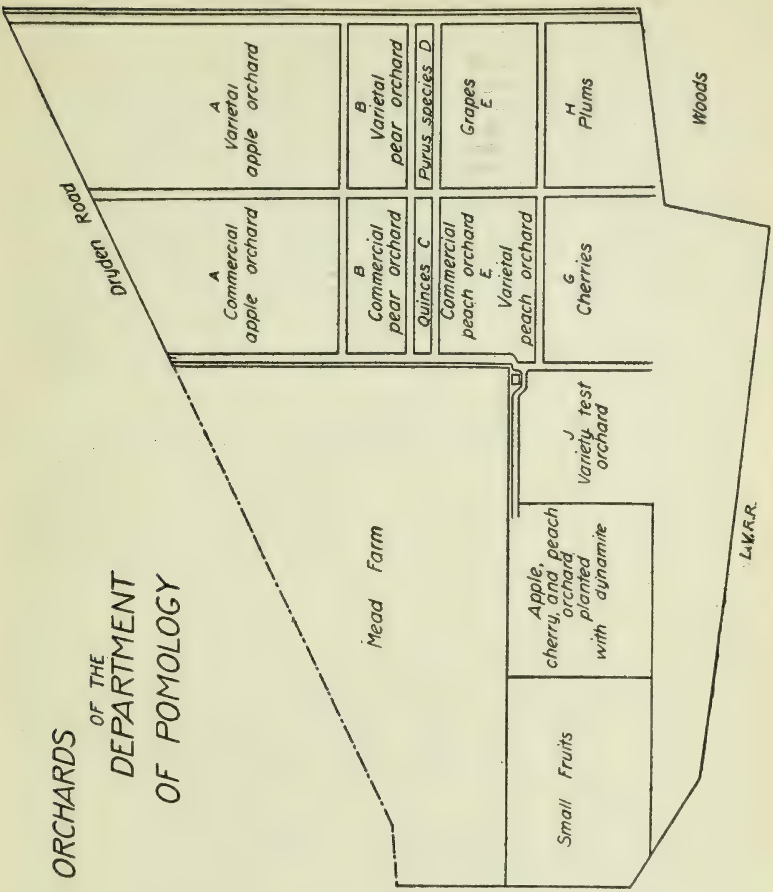
(*b*) *Oat and barley investigations.*— On section IX, block 1, are being grown several series of rows of oats. One of the largest series consists of new hybrids and selections grown in comparison with a large number of commercial varieties in order to determine the highest-yielding sorts. There are thirty-seven hybrids and selections and one hundred and six commercial varieties in this test. This work has been in progress since 1907.

About six hundred new head selections were made from various fields in 1912, and these are being grown in head rows. The best of these will be saved, the seed increased, and further tests made in order to determine the best-yielding sorts.

About forty varieties of barley are being grown on section IX, block 1, in rod rows, which will serve as a basis for improvement work with barley.

POMOLOGY EXPERIMENT AND DEMONSTRATION PLATS

The rapid expansion of the University necessitated, in 1908, the inclusion in the main campus of the ground formerly used for fruit experiments. At that time fifty acres of land, about half a mile from the College and lying south of Dryden Road, was assigned to the Department of Pomology for the development of new orchards. The soil was mainly a heavy clay and was in poor condition, having been under a sod of weeds and wild grasses for more than ten years. In the first year three five-inch tile drains were placed in the hollows running east and west across the field; the placing of laterals was left until more funds should be available. In the fall of 1908 about ten acres were plowed and a few trees were planted. The season following was extremely dry, and because of the poor physical condition of the soil



Orchards of the Department of Pomology

the trees made but little growth. For this reason further planting was discontinued until cultivation and manuring could improve the condition of the soil.

The plantings.— In the fall of 1910 planting was begun in earnest. The accompanying map shows the general outline of the plans followed in planting. About half of the land given up to each fruit is for a commercial orchard, the other half is for the testing of varieties and species of that fruit. During the fall of 1910 most of the trees in orchard A, the apple orchard, were set; in the following spring this orchard was completed and orchard B, the pear orchard, was planted. In the spring of 1912 the quinces, and many of the peaches, grapes, plums, and cherries, were planted. In the fall of 1912 it was found necessary to begin a general variety-test plat. This was laid out on an L running west from the main field, and was called orchard J. This was largely filled during the spring of 1913.

At the present time, therefore, the apple and pear trees are in their third season; practically all the other trees, except those in orchard J, are making their second season's growth. The plantings contain over four hundred varieties of fruits and nearly two thousand plants, and cover about twenty-five acres.

The main purposes of these plantings are:

1. To serve as a laboratory for investigation.
2. To furnish an opportunity for testing fruit varieties and species.
3. To supply material for laboratory study for students in the department.

Treatment.— No intercrop has been planted until this year, but cover crops have been sown each fall. In 1911 buckwheat and oats were used, and in 1912 buckwheat, rye, and oats. The intercrops this year are so placed as not to interfere with the trees, and the cultivation and fertilization required by the beans, carrots, beets, and cabbages will be a direct benefit to the trees.

Small fruits.— Because of the work required in planting the tree fruits, little has yet been done with bush fruits and strawberries. During the next few years, as the small fruits are planted they will be used as intercrops among the peaches and the cherries on the gravelly hill in the middle of the plantation. An experiment to test varieties of strawberries for canning was started this spring, and it is being duplicated on the heavier soil in the quince orchard in order to determine the influence of these soils on the quality of the fruit.

The only bearing trees under the control of the department are in an orchard of two and one half acres, east of the Bool greenhouses on the McGowan farm. This orchard has been rented by the department since 1910. At that time the orchard was in a state of neglect, having been in sod for a number of years and having received little or no pruning. Many of the trees are now suffering from lack of pruning or from unwise pruning received during the period of neglect. The cultivation and manuring given the orchard in 1910 began to have its effect in 1911. The crop for that year was 642½ bushels, an average of 11 bushels per bearing tree. The crop for last year, with only an average set of fruit, was 872 bushels, an average of 15 bushels per tree.

CRAIG FIELD

Just beyond the pomology experiment and demonstration plats is Craig Field, which has been assigned to the departments of Floriculture and Vegetable-gardening.

Floriculture Plats

The Department of Floriculture has twenty acres for growing the large collections of annual and perennial plants that are now being established. One of these, the largest collection of correctly named varieties of **peonies** to be found anywhere in the world, was assembled for cooperative work in conjunction with the American Peony Society. As new varieties of peonies appear they will be added, so as to furnish a living herbarium for the identification and study of varieties.

Irises and phloxes.— There are extensive collections of irises and perennial phloxes.

Sweat peas and gladioli.— The department has been conducting cooperative work with the American Sweet Pea Society and the American Gladiolus Society. Each year, in their season, three to five hundred varieties of these flowers may be found growing in the trial grounds.

Roses.— A complete collection of climbing roses has been established this year (1913). A large collection of hardy perennials has been planted for the instruction of students, and these will enable the department to determine the availability of the plants for planting in home grounds under New York conditions.

Vegetable-garden Plats

The vegetable garden on the west side of Craig Field is used for experimental and demonstration plantings and for the growing of material for systematic studies. It is the purpose of the Department of Vegetable-gardening to grow each year the leading varieties of all the important vegetable crops, for comparison and description. A comprehensive experiment to determine the best methods of maintaining fertility in asparagus plantations on heavy soils is being established on a one-acre block. Home gardens of three sizes, planned and planted to meet the needs of the small city holder, the suburban dweller, and the farmer, are being located here. They are to be maintained year after year, and complete records are to be kept showing outlay in labor and expense, as well as returns.

The student practice gardens of the Department of Vegetable-gardening occupy the crest of the hill east of the East Ithaca Station of the Lehigh Valley Railroad, not far from the city water tank. Students are assigned to plots of the sandy soil, which is well adapted to early cultivation in the spring. The students make the plantings and assume full charge until the end of the college term, thus becoming familiar with the plants and their habits as well as learning something of cultural methods. Part of the systematic and experimental plantings are also maintained here. Irrigation is practiced on these grounds.

BOTANIC GARDEN

The College is gradually assembling a large, growing collection of cultivated plants in the crop garden, breeding grounds, plant-disease garden, nurseries, and other areas. Collections are to be made of a wide variety of cultivated plants about the buildings and in the intermediate spaces. The area extending from the Auditorium on the west to the new Animal Husbandry buildings on the east is large and presents many exposures and conditions. It is expected that the requirements of ornamental planting can be combined, to a considerable extent, with the need for illustrative specimens of species and varieties. Ultimately nearly the entire cultivated hardy flora may be represented on the college grounds; and this collection may join on the east and south with the garden of the native and other flora that the University designs to establish there. This will extend what will be practically a botanic-garden planting around three sides of Alumni Field, with the grouping and disposition of specimens serving purposes of beauty and general interest.

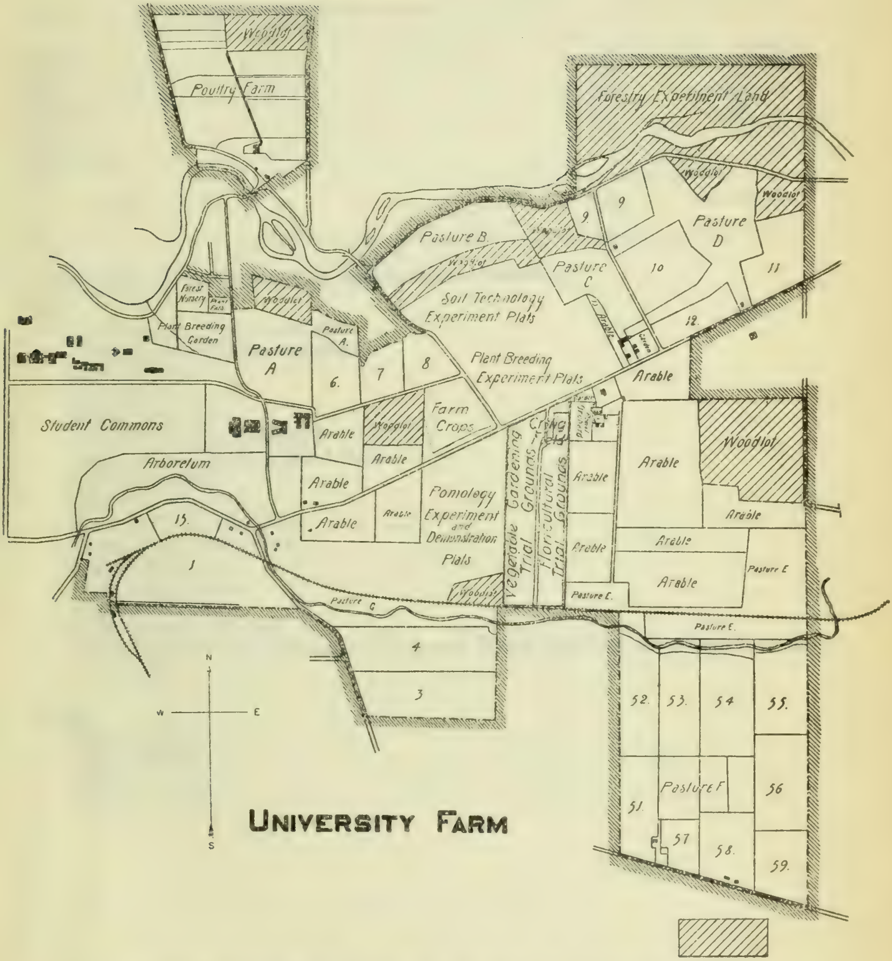
WOODLOTS AND FOREST LANDS

Eight woodlots on the university farms are supervised by the Department of Forestry. On these are growths of white pine, hardwoods, and hemlock, which in the past have been somewhat neglected; they are now being placed under management as rapidly as possible. There is also a farm of thirty-eight acres along Fall Creek, about one mile east of Forest Home, part of which is open land, which is being used for experimental forest plantations. The department maintains also a forest nursery, located directly east of Craig Field, in which trees of several species are being raised for planting purposes.

On university lands near Varna, about three miles from the campus and at the extreme northeastern corner of the farm, the department is planting a large number of forest trees on the watershed surrounding a reservoir site. During the last two years about fifty acres of land have been covered with trees, chiefly white pine; the remaining one hundred acres or more will be planted during the coming seasons.

POULTRY FARM

The poultry farm is located about one and one quarter mile from the new Poultry Husbandry Building, on the plateau north of Forest Home and at the extreme northern end of the university farm. The farm consists of eighty acres, on which are located the colony houses for rearing about five thousand chickens and the experimental houses accommodating about thirteen hundred fowls. The farm is provided with two barns for the storage of grain and supplies. The principal crops grown are hay, oats, corn, root crops, and alfalfa for green food. The farm is provided with a permanent



Cross-sectioned areas indicate woodlots on university farm

water supply from a driven well one hundred and thirty-nine feet deep, the water being elevated into a supply tank by a windmill.

The stock on the poultry farm as shown by the inventory of 1913 is as follows:

	Number	Value
Ducks	50	$ 50.00
Geese	22	66.00
Young chickens	5,370	1,841.15
Fowls	2,350	2,483.50
Capons	10	18.00
Pheasants	8	12.00
Total	7,810	$4,470.65

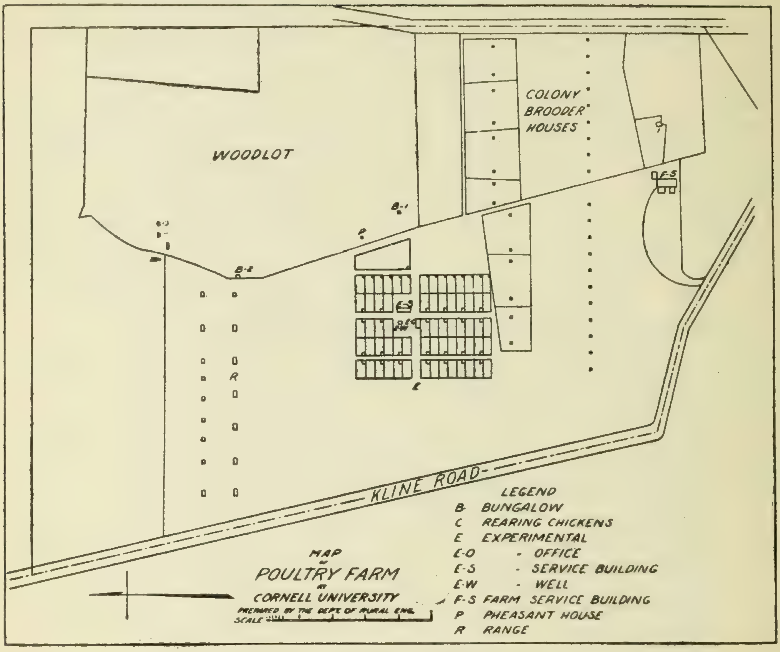
The names of the breeds and varieties are as follows:

Fowls
- Single-comb White Leghorn
- Single-comb Brown Leghorn
- Buff Leghorn
- Ancona
- Black Minorca
- Silver-spangled Hamburg
- Single-comb Rhode Island Red
- Buff Orpington
- White Orpington
- Barred Plymouth Rock
- White Plymouth Rock
- Buff Wyandotte
- White Wyandotte
- Light Brahma
- Buff Cochin Bantam
- Cross-bred Barred Plymouth Rock and White Leghorn, for experimental purposes

Ducks
- White Pekin
- Wild Mallard
- Rouen
- Indian Runner

Geese
Toulouse

Pheasants
English Ring Neck



Map of the poultry farm

Purpose of the work.— The poultry flocks are kept primarily for instruction and for investigation. These purposes are considered to be of about equal importance. The flocks provide the laboratory materials with which staff and students work; they enable the teacher to apply the principles that are taught, and the student to acquire knowledge and skill by contact. The flocks are also of value in providing instruction to the large number of persons who visit the college plant and the poultry farm.

Four to five thousand chicks are reared annually on the poultry farm at Forest Home. The farm comprises about eighty acres. It is devoted largely to clover, alfalfa, mangels, and grain crops, demonstrating a desirable system of rotation for a poultry farm, with the object of illustrating by actual results that the most profitable and the only permanent poultry husbandry must be based on the keeping of poultry as a part of a regular system of farm cropping, maintaining soil fertility, and reducing the cost of maintenance.

Nearly all the work on the farm, including hatching, rearing, feeding, cropping, and the like, is performed by students or by persons who have received instruction in class. The farm is a laboratory for the teaching of as many students as the facilities will permit. The working force, therefore, is continually changing. Inexperienced persons are constantly taking the places of experienced persons, the latter being recommended to positions of greater responsibility.

The annual sales from the flocks amount to six or seven thousand dollars. This business provides an opportunity for students to become familiar with the commercial side of poultry farming, from both the productive and the administrative viewpoint.

INVESTIGATIONS IN PROGRESS

Many of the investigations that are in progress on the farms have been discussed in the preceding pages under the description of the farms. Reference to them by page number will be made here.

Following is a list of investigations that are now being conducted by the several departments of the College.

Agricultural Chemistry

1. Study of the sulfur content of evaporated apples. L. J. Cross.

Animal Husbandry

1. Feeding experiments with horses:
    Oats compared with corn and oats for the work horse. M. W. Harper.
    The effect of food given to brood mares on the growth and development of offspring. M. W. Harper.
    Food required to raise a colt from birth to three years of age. M. W. Harper.
2. Feeding experiments with cattle:
    Food required for milk production. E. S. Savage.
    Food required to raise a calf from birth to maturity. Cost of raising heifers. E. S. Savage.
3. Feeding experiments with sheep:
    Food required to maintain a breeding flock. H. H. Wing.
    Food required to produce fat lambs. H. H. Wing.

4. Feeding experiments with swine:
   - Breed test in pork production. H. H. Wing.
5. Breeding experiments:
   - Improving farm horses. M. W. Harper.
   - Increasing butter-fat production in dairy cattle. H. H. Wing.
   - Herd improvement. H. H. Wing.
   - Selecting for early lambs. H. H. Wing.

Botany

1. Problems in legume inoculation. L. Knudson and J. K. Wilson.
2. Physiological studies of legume bacteria. L. Knudson and J. K. Wilson.
3. Growth and metabolic activities in fruit trees. R. Nanz.
4. The nutrition of higher plants. L. Knudson.
5. Enzyme secretion and production by fungi. W. J. Robbins.
6. Senility in plants. H. M. Benedict.
7. Problems in fermentation. L. Knudson.
8. Studies in the practical identification of grasses when not in flower. F. P. Metcalf.
9. Root structures from anatomical and physiological standpoints. C. C. Thomas.
10. The anatomy of water plants from a pedagogical point of view. Miss G. E. Douglas.
11. Studies in the practical recognition of the families of cultivated plants. H. A. Severy.
12. The recognition of rosette plants for pedagogical purposes. Miss R. S. Rodman.
13. Plant distribution on the island of Newfoundland from geographical and lithological standpoints. K. M. Wiegand.

Dairy Industry

1. Variations in cream in the hand separator. E. S. Guthrie.
2. Methods of cooling milk. H. E. Ross and T. J. McInerney.
3. Metallic flavor in butter. E. S. Guthrie.
4. Yield of cheddar cheese. A study of the amount of cheese that can be made from a given quantity of milk. W. W. Fisk.
5. A test for moisture in cheese. H. C. Troy and V. R. Jones.
6. The organisms found in spoiled canned peas and beans. Miss E. F. Genung.

Entomology

1. The tarnished plant bug as a nursery pest. C. R. Crosby.
2. Other sucking insects in nurseries. C. R. Crosby.
3. The bud midge on roses. C. R. Crosby.
4. The codling moth. G. W. Herrick.
5. The hop plant louse. G. W. Herrick.

Farm Crops (See page 2356)

Farm Management

1. Agricultural surveys in Tompkins, Livingston, and Jefferson counties. G. F. Warren.
2. A continued study of successful farms found by the survey method, and of farms that are successful under adverse conditions, such as on poor soils and the like. K. C. Livermore.
3. Cost of producing milk, studied by the survey method in Delaware county, New York. A. L. Thompson.
4. Cost accounting. C. E. Ladd.
5. Cost of producing potatoes, studied by the survey method. D. S. Fox.

Farm Practice

On the farms there are being conducted, under the general supervision of Professor J. L. Stone, a number of pieces of work that might be termed experimental, as follows:

1. Tests of the durability of various roofing materials.
2. Tests of the comparative durability of Bessemer and open-hearth steel in wire fencing.
3. A study of the effects of farm drainage.
4. Different treatments of pasture land, looking toward its improvement.
5. An attempt to grow alfalfa without manure.
6. Tests of soy beans, with the purpose of improving the quality of silage.
7. Comparing pyrox with homemade bordeaux mixture for blight on potatoes.

Floriculture (See page 2383)

1. Peony investigation. A type collection of about five hundred varieties now growing. This is a cooperative experiment with the American Peony Society. Flowering season, June. A. C. Beal.
2. Sweet pea investigation. A nomenclatural study of sweet peas. A large collection of varieties, including the latest novelties, are grown each year. This experiment is in cooperation with the American Sweet Pea Society. Flowering season, July. A. C. Beal.
3. Gladiolus investigation. Over five hundred varieties of gladioli are now being tested. This is an experiment in cooperation with the American Gladiolus Society. Flowering season, August. A. C. Beal.
4. Rose investigation. This work was begun in the spring of 1913, and all the varieties of hardy climbing roses are being tested. Other varieties will be imported. Dwarf roses will be included as the work progresses. Flowering season, June and July. A. C. Beal.

5. Iris investigation. A large collection of irises is now growing on the grounds of the department. Flowering season, May and June. A. C. Beal.
6. Investigation of perennial phlox. A complete collection is being grown on the station grounds. Flowering season, August. A. C. Beal.
7. Investigation of china asters. A collection of over three hundred varieties and types of this flower is the basis of a complete study. Flowering season, August and September. A. C. Beal.
8. Miscellaneous trials of annual and perennial flowers. A. C. Beal.
9. Greenhouse investigations. A. C. Beal.

Forestry (See page 2384)

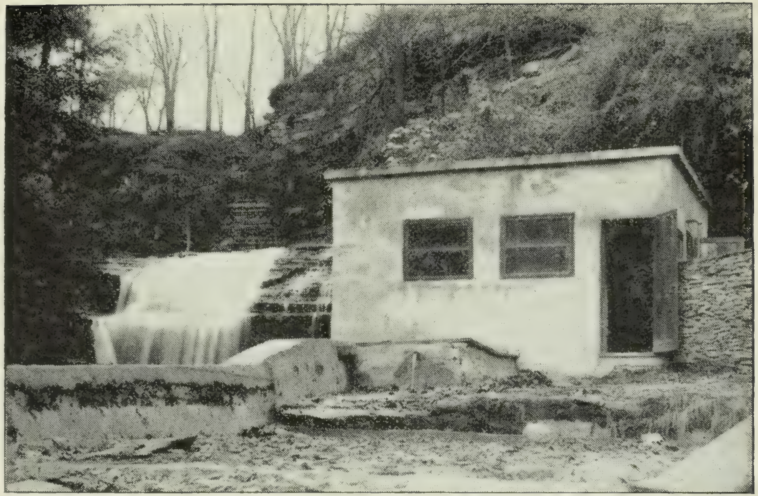
1. Tests of the adaptability of a number of forest-tree species to this region. S. N. Spring.
2. The effect of various spacings in forest plantations. S. N. Spring.
3. Permanent silvicultural sample plots for the study of the rate of growth of timber trees. John Bentley, jr.
4. The effect of three kinds of cuttings on the quality and rate of growth of the forest: (a) cleaning, (b) improvement cutting, (c) thinning. Walter Mulford.
5. Reproducing the forest crop by natural seeding. Walter Mulford.

Home Economics

1. A study of methods of commercial farm canning. Flora Rose, Claribel Nye, and Bessie Austin.
2. An investigation as to the proportion of income spent for clothing, with an income of one thousand dollars in a family of five persons. Martha Van Rensselaer and Bertha Titsworth.

Plant-breeding (See pages 2354 and 2378)

1. Oat- and wheat-breeding, in order to increase yield and obtain better sorts for distribution, and to study methods of oat and wheat improvement. H. H. Love.
2. Correlation studies, in order to determine the correlation of characters in the cereals and to learn their use in breeding. A cooperative study along this line is being conducted between the Montana Agricultural Experiment Station and this laboratory, in order to learn the effect of environment on correlation. H. H. Love.
3. Mendelian studies. Crossing of the different varieties of wheat and oats, in order to determine the inheritance of their qualitative and quantitative characters. H. H. Love.
4. Selection experiments. Pure-line selection experiments are being conducted with wheat and oats, in order to determine the possibility of changing the type within the line of selection. H. H. Love.



The fish hatchery, Cascadilla Creek

5. Chrysanthemum experiments. A study of the common field daisy is being conducted, in order to separate the different types and to learn which ones have a tendency to reproduce their characters. H. H. Love. A study is being made in order to determine the effect of environment on the variation of the number of ray florets. H. H. Love. A place variation study is being made in order to learn the difference in variation from year to year. H. H. Love.
6. Mendelian study of morning-glories. This study is for the purpose of determining the mode of inheritance of the different characters of the morning-glory. E. E. Barker.
7. Mendelian study of barley. A study in order to determine the inheritance of the qualitative and quantitative characters of barley. W. O. Whitcomb.
8. Mendelian study of radishes. A study in order to determine the inheritance of the qualitative and quantitative characters of the radish. N. Menderson.
9. Timothy-breeding experiments, in order to produce better-yielding varieties, better adapted to their local conditions through their different seasons of maturity, habit of growth, and the like. From the scientific standpoint, the variability, correlation, and inheritance of various characteristics of timothy are being carefully studied. C. H. Myers.
10. Potato-breeding. The experiment is designed to study bud variation within pure-tuber lines and the effect of continued selection within these lines. The experiment will also throw light on the practical method of hill selection and the comparative vigor of seed and stem end, as well as on other points of practical interest. In the course of the experiment, good-yielding strains may be obtained for distribution among potato-growers of the State. C. H. Myers.
11. Nutrition studies. A study of variation, correlation, and inheritance of characters of plants grown under different conditions of fertility. C. H. Myers.
12. Experiments with buckwheat and field beans. C. H. Myers.

Plant Pathology (See page 2354)

1. An investigation of the various diseases of the peony. H. H. Whetzel.
2. Ginseng-disease investigation. H. H. Whetzel and J. Rosenbaum.
3. Crown-gall investigation. An experiment designed to determine the injury caused to apple and peach trees by the crown-gall disease. Donald Reddick and V. B. Stewart.
4. The Thielavia disease of violets. An investigation of the nature, cause, and control of the violet disease. Donald Reddick.
5. Investigation of the dead-arm disease of grapes, in all its phases. Donald Reddick.

6. Bean diseases. An investigation of bean diseases, with special reference to the anthracnose disease and the testing of a method of control. M. F. Barrus.
7. Grape diseases. An investigation of the nature, cause, and control of downy mildew and ripe rot of the grape. C. T. Gregory.
8. Gladiolus hard-rot. An investigation in order to determine the identity and pathogenicity of the hard-rot organism. H. M. Fitzpatrick.
9. Fungous flora of the potato. In order to determine what fungi are associated either harmfully, beneficially, or innocuously with potatoes. C. D. Sherbakoff.
10. Soil fungicides. An investigation of the control of certain potato, onion, aster, and carnation diseases by the application of fungicides to the soil. I. C. Jagger, C. D. Sherbakoff, and R. C. Faulwetter.
11. Fungous diseases of the nursery. An investigation for the purpose of determining satisfactory and economical means of controlling nursery diseases. V. B. Stewart.
12. Hop diseases. An investigation of the various diseases of the hop plant, with special reference to mildew. F. M. Blodgett.
13. Dusting investigations. Designed to determine, if possible, a method of controlling fruit diseases by the application of a fungicide in the dry state. F. M. Blodgett and Donald Reddick.
14. New York apple-tree canker. An investigation of all phases of the diseases of apple trees, with special reference to the disease caused by *Sphaeropsis malorum*. L. R. Hesler.
15. Chestnut-bark canker. An inquiry into the nature and the cause of the chestnut-bark disease. W. H. Rankin.
16. Iron-sulfate investigations. Designed to determine the fungicidal value of sulfate of iron. C. G. Crittenden and W. H. Burkholder.
17. Spraying investigations. A study of the types of fungicides in their relation to efficiency and to their effects on the host plants. G. A. Osner.
18. Bulb diseases. An investigation of the diseases of gladiolus and other bulbous plants, with special reference to methods of control. L. M. Massey.
19. Raspberry diseases. An investigation of raspberry diseases, with special reference to anthracnose, crown rot, and yellows. W. H. Burkholder.
20. Oat smut. An investigation for the purpose of determining more efficient means of controlling this disease. R. J. Haskell.
21. Winter injury. An investigation of the action of frost and cold, with special references to the apple. A. J. Mix.
22. Gooseberry diseases. An investigation of the nature and cause of gooseberry necrosis. Donald Reddick.
23. Celery diseases. An investigation of the keeping qualities of celery under refrigeration, with special reference to the keeping of diseased stock. Donald Reddick.

Pomology (See page 2380)

1. A study of the commercial varieties of fruits adapted to the colder regions of New York State. W. H. Chandler.
2. A study of fruit varieties for the home orchard and garden. W. H. Chandler.
3. Renewal of an old orchard. W. H. Chandler.
4. A study of the stocks best adapted to the propagation of commercial varieties of fruits. W. H. Chandler.
5. The value of irrigation in a New York apple orchard. W. H. Chandler.
6. The value of irrigation in a New York peach orchard. W. H. Chandler.

Poultry Husbandry (See page 2384)

1. A comparison of different methods of feeding. J. E. Rice.
2. Free range of outdoor liberty in winter in comparison with confinement within the house. J. E. Rice.
3. A study of the inheritance of egg production. J. E. Rice.
4. A comparison of large, grass yards with small, bare yards for poultry. J. E. Rice.
5. A comparison of egg production and constitutional vigor of hen-hatched chickens with those of incubator-hatched chickens. J. E. Rice.
6. Breeding in order to improve the size, shape, and color of market eggs. E. W. Benjamin.
7. An experiment comparing several methods of keeping eggs before incubating them. G. H. Pound and G. H. Masland.
8. The comparative value of animal protein and mineral nutrients in the feeding of fowls for egg production. L. E. Dallenbach.
9. Sex influence on the inheritance of egg production. E. L. Andrews.
10. Sex influence on the inheritance of constitutional vigor. O. B. Kent.
11. A study of types in poultry-house construction. C. A. Rogers.

Rural Economy

1. Statistical study of food production in America. G. N. Lauman.

Rural Engineering

1. Special studies of water supply and sewage disposal are in progress, particular attention being directed toward the development of sewage-disposal systems that are efficient, simple, and inexpensive. H. W. Riley.

Soil Technology (See page 2358)

1. Influence of soil moisture on the availability and utilization of plant nutrients in soils. T. L. Lyon and J. A. Bizzell.

2. A study of the composition and concentration of the water-soluble material of soils under different methods of treatment. T. L. Lyon and J. A. Bizzell.
3. The conditions under which calcium is removed from soils, and the changes that accompany its removal. T. L. Lyon and J. A. Bizzell.
4. A study of some of the physical and chemical properties of types of soil covering a certain region, in order to determine their constancy, and the uniformity of their fertilizer needs. E. O. Fippin, T. L. Lyon, and J. A. Bizzell.
5. A comparison of the practice of fertilizing for hay crops with that of fertilizing for grain crops in a rotation of timothy and clover three years, followed by corn, oats, and wheat, each one year. T. L. Lyon.
6. The influence of the application of calcium in certain different chemical combinations, and of ground limestone in different degrees of pulverization, on the productiveness of certain loam and clay soils. T. L. Lyon, E. O. Fippin, and J. A. Bizzell.
7. Top-dressing alfalfa with farm manure and with different fertilizers. T. L. Lyon.
8. Continuous cropping of land with corn, oats, and hay; the latter crop being designed to maintain the supply of organic matter in the soil, but omitting entirely a return of mineral matter to compensate for that annually removed by the crop. T. L. Lyon.
9. The nitrogen balance in soil growing alfalfa and in soil growing timothy when the hay crops are removed. T. L. Lyon and J. A. Bizzell.
10. The use of fertilizers on a nurse crop with which timothy or timothy and clover are sown. T. L. Lyon.
11. The fertilizer needs and lime requirements of certain muck soils. E. O. Fippin.
12. The fertilizer needs of soils as determined by comprehensive field-plat experiments continued over a period of years at selected points on the more extensive types of soil in the State. E. O. Fippin.

Vegetable-gardening (See page 2383)

1. An experiment for determining the best method of supplying nitrogen to muck-land crops. Paul Work and A. E. Wilkinson.
2. A study of the lima bean, its varieties, cultivation, and fertilization. C. E. Dimon.
3. An investigation for determining the best method of maintaining permanent fertility in asparagus beds. Paul Work.
4. The influence of potash and phosphoric acid in addition to manure on greenhouse cucumbers and tomatoes. A. E. Wilkinson.

COLLEGE EXTENSION WORK

The extension enterprises are the means of carrying instruction to persons who are unable to come to the College. These enterprises include all educational efforts at the homes and on the premises of farmers, and therefore much of the direct-contact work. The following are some of the means employed: inspection of farms; the giving of advice by correspondence; publications of an educational nature; cooperation with societies, organizations, and schools; the organization of boys' and girls' clubs; the conducting of reading-courses; experiments and demonstrations on farms; the running of farm trains or traveling schools; the holding of an annual Farmers' Week; special lectures and lecture courses; the conducting of local extension schools; and other means of helpfulness to the agricultural interests of the State.

The organization of general extension activities is administered by the Department of Extension Teaching in cooperation with an extension committee representing the several departments of the College. The execution of the plans lies with the separate departments themselves. There is no special extension staff; each department assists in extension work by handling those features that are a part of its particular field of work. The work is cooperative also with the communities, organizations, or individuals in the State receiving help, these paying half, or in some cases all, of the expenses incurred in the particular piece of work.

GENERAL EXTENSION ENTERPRISES

Special lectures.— Lectures are given, on request, by members of the college staff at such times and places as can be arranged, before granges, reading-course clubs, and other agricultural societies, and before schools and public assemblies. Organizations desiring such lectures should address the Department of Extension Teaching, College of Agriculture, Ithaca, New York.

Educational fair exhibits.— The College cooperates with the State Fair each year, and with as many county fairs as is practicable, by furnishing educational exhibits on request. Representatives in attendance explain the exhibits and maintain an information bureau. Similar exhibits are provided also for farmers' meetings of various sorts.

Cooperative experiments.— The College cooperates with farmers in making on their land experiments that will be of direct practical value to them. The organizations that are now cooperating with the College are the New York State Experimenters' League, the New York State Drainage Association, the New York State Plant Breeders' Association, the New York State Vegetable Growers' Association, and the Home-makers' Conference.

Demonstrations.— On request, demonstrations on whatever actual work is in progress may be conducted on farms, in order to show how crops, animals, or methods of work may be economically improved.

Farm visits.— A limited amount of work is now undertaken by members of the college staff in visiting farms and giving advice as to their organization or as to special problems. Farmers thus assisted are asked to pay all the traveling expenses of the representative.

Traveling schools.— Cars equipped for instruction in certain lines of agriculture are sent into sections of the State where demands arise. Stops are made at places previously scheduled and announced. The schools are conducted by the College in cooperation with the railroad over whose lines the cars are operated. As an indication of the arrangements for such traveling schools, and the interest in them, there is included here a summary statement concerning those held during the past winter.

TRAVELING SCHOOLS*

Subject	Date	Stops	Attendance
Poultry	October 28–31, 1912	Syracuse	900
	October 29, 1912	Auburn	200
	October 29, 1912	Seneca Falls	175
	October 29, 1912	Geneva	400
	October 30, 1912	Canandaigua	150
	October 30, 1912	Honeoye Falls	55
	October 31, 1912	Le Roy	120
	October 31, 1912	Batavia	100
Total attendance			2,100
Soils and dairy	November 12–14, 1912	Chatham	210
	November 12, 1912	Craryville	40
	November 12, 1912	Copake	75
	November 13, 1912	Millerton	80
	November 13, 1912	Amenia	65
	November 13, 1912	Dover Plains	180
	November 14, 1912	Wingdale	42
	November 14, 1912	Pawling	70
	November 14, 1912	Patterson	65
Total attendance			827
Vegetable-gardening	March 31–April 5, 1913	Newburgh	180
	April 1, 1913	Kingston	140
	April 2, 1913	Catskill	70
	April 2, 1913	Coxsackie	64
	April 3, 1913	Albany	270
	April 4, 1913	Schenectady	375
	April 5, 1913	Troy	269
Total attendance			1,368

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*In cooperation with the New York Central and Hudson River Railroad.

Extension schools.— Schools of one to three weeks in duration are conducted by members of the college staff in various parts of the State where there is a demand. They are conducted as regular schools, with definite class periods and class work. A few lines of study of particular value to the locality immediately concerned are carried throughout the period of the school. A tuition fee of $1.50 per week for each person is required and regular class attendance is expected. Forty to seventy-five persons constitute a satisfactory number for a class. A local organization cooperates in the arrangements for the school.

Following is a summary statement concerning the extension schools held during the winter of 1912–1913:

Extension Schools, December 1, 1912, to March 31, 1913

Town	County	Date	Registration		Total
			Men	Women	
Perry	Wyoming	Dec. 9–14	45	26	71
Walton	Delaware	Dec. 9–14	20	11	31
Salamanca	Cattaraugus	Dec. 16–21	11	7	18
Mexico	Oswego	Dec. 30–Jan. 4	43	27	70
Oneonta	Otsego	Dec. 30–Jan. 4	33	......	33
Poland	Herkimer	Jan. 6–11	23	22	45
Sinclairville	Chautauqua	Jan. 13–18	50	......	50
Lowville	Lewis	Jan. 20–25	23	23	46
North Bangor	Franklin	Jan. 20–25	31	......	31
Kinderhook	Columbia	Jan. 27–Feb. 1	41	51	92
Southampton	Suffolk	Jan. 27–Feb. 1	27	36	63
Ravena	Albany	Feb. 3–8	49	......	49
Le Roy	Genesee	Feb. 3–8	28	......	28
Lockport	Niagara	Feb. 17–22	84	......	84
Alden	Erie	Feb. 17–22	32	3	35
Geneseo	Livingston	Feb. 24–Mar. 1	36	5	41
Mountainville	Orange	Feb. 24–Mar. 1	28	6	34
East Bloomfield	Ontario	March 3–8	51	31	82
Ticonderoga	Essex	March 3–8	30	4	34
Watertown	Jefferson	March 10–15	23	......	23
Holley	Orleans	March 10–15	67	......	67
Johnstown	Fulton	March 17–22	46	3	49
Lincolndale	Westchester	March 24–29	65	4	69
Hannibal	Oswego	March 24–29	33	22	55
Total, 24 schools, 23 counties, 24 weeks			919	281	1,200
Average attendance			38.29	11.71	50.00

The New York State Experimenters' League.— The New York State Experimenters' League is an organization developed from a small league of former students of the College of Agriculture who desired to investigate some special problems by experimentation on their own farms. The membership of the league has now been extended to all persons who wish to attack some of their farm problems by means of simple home tests.

The gradually changing soil conditions as our lands grow older, the rapidly changing prices of labor and of farm produce, and the constant discoveries of new scientific facts make it necessary that the farmer be alert and ready to change his farm practices so as to meet these constantly changing conditions. In order to meet these conditions there is a growing tendency among farmers to experiment. Sometimes the trials are made by such imperfect methods that wrong conclusions may be drawn. The aim of the league is, not to take up extended research, but to encourage the farmer to undertake experiments by methods that are accurate but not complicated, to set each man at work on his own problems, to help him to learn from the experience of others, to bring him in touch with the latest results of experiment station work in order that he may test these results and determine whether they are applicable to his home conditions — in short, the aim is to help the farmer to better understand his own problems and conditions and to find better practices and methods in his farming.

The New York State College of Agriculture cooperates in this work by giving advice in such ways as it can. Sometimes the advice desired by the farmer is such that it can be given by correspondence; sometimes a personal visit from a specialist from the College is desired. The College arranges these visits on the request of farmers, the latter paying the traveling expenses of the college representative.

The annual meeting of the Experimenters' League is held at the College during Farmers' Week, in February. At this meeting reports are given of the work done during the year by the members. If funds are available, the reports are printed and distributed to the members. Persons desiring to take up experiments and become members of the league should communicate with the Secretary of the Experimenters' League, Department of Extension Teaching, College of Agriculture, Ithaca, New York.

Farmers' Week.— A week for the gathering of farmers and farm women at the College. Lectures and demonstrations by members of the faculty, and by farmers, specialists, and others who have achieved successes in agriculture, are given throughout the week. Last year over three hundred lectures were given and over three thousand persons attended during the week. The museums of the College are open, and the various departments prepare special educational exhibits. At this time meetings are held at the College by the New York State Drainage Association, the Cornell Dairy Students' Association, the Experimenters' League, the Home-makers' Conference, the New York State Plant Breeders' Association, the Students' Association of the

New York State College of Agriculture, the New York State Vegetable Growers' Association, and other agricultural societies and conferences.

Excursions.— The College is glad to receive excursional parties from granges, farmers' clubs, and other organizations. Meeting-places and other facilities are provided for such organizations as may wish to hold meetings at the College.

Bureau of information.— Questions pertaining to farm problems are referred to the various departments of the College for reply. Correspondence is solicited.

Personal inspection.— The College is always open to visitors. Persons applying at the public office will be provided with a guide. Inspection of the buildings, of the farm of nearly nine hundred acres, of the college herd of pure-bred cattle, and of the sheep, swine, and poultry, is invited.

Employment office.— The College desires to maintain a list of the most successful farms in New York State, managed by fair-dealing men, where may be placed students desiring summer work either for experience or in order to earn money to apply on college expenses. For a place on this list and for information concerning the classes of students available, address Department of Farm Practice, College of Agriculture.

Correspondence.— The specialists at the College are ready to give assistance in the solution of individual problems by means of correspondence. Persons in the country needing advice on any practical questions in connection with their work are encouraged to make their needs known to the College. Inquiries will receive prompt and careful attention.

DEPARTMENTAL EXTENSION ENTERPRISES

All departments of the College share in the foregoing general extension enterprises. In addition some of the more specialized and strictly departmental forms of extension work are listed here.

Agricultural Chemistry

1. *Chemical tests of soil.*— The Department of Agricultural Chemistry examines without charge samples of soil for lime requirement.

Animal Husbandry

1. *Establishing pure-bred herds and flocks.*— The Department of Animal Husbandry desires particularly to assist breeders and farmers in establishing pure-bred herds and flocks.

2. *Cow-testing associations.*— Members of the staff are available for aid in establishing cow-testing associations and local breeders' associations wherever there is a desire on the part of communities for such assistance. A circular on cow-testing associations will be sent on request to any one desiring information.

3. *Advanced registry tests.*— Testing for advanced registry has reached greater proportions in New York than in any other State in the Union. This

work has done much for the improvement of dairy cattle in this State. Information as to the making and the cost of tests, and suggestions as to feeding and management of cows on test, are available to breeders. In all, one hundred and thirty-six persons have been engaged in this work, at one time or another, during the past year.

Botany

1. *Inoculation for legumes.*— The Department of Botany distributes pure cultures of nodule-producing bacteria for legume crops.

Dairy Industry

1. *Cow-testing associations.*— The Department of Dairy Industry has conducted a cow-testing association among its own patrons for four or five years. The work of this association is similar to that done by other similar associations in the State.

2. *Scoring of dairy products.*— The department conducts educational scoring of the different kinds of dairy products, including milk, cream, butter, and cheese. Persons wishing to have their products scored on the basis of market requirements should send a sample to the department once each month.

3. *Testing of dairy products.*— Any person in New York State may send to the Department of Dairy Industry samples of milk, cream, butter, or cheese to be tested for fat, moisture, salt, bacteria, or preservatives.

4. *Personal advice.*— The department has one extension instructor who gives the greater part of his time to work among the dairymen of the State. His efforts are directed primarily toward assisting former students who are located in dairy plants in this State. Any one wishing his assistance, however, may receive it by communicating with the department.

Entomology

1. *Control of insect pests.*— This department is engaged in studying the more pressing problems connected with the control of insect pests of fruit trees, nursery plants, truck crops, forage crops, shade and forest trees, hops, and poultry. Much of this work is conducted in cooperation with growers or associations, either through cooperative experiments or by means of industrial fellowships. As time permits, members of the staff are available for visits to farms for consultation concerning special insect problems.

Farm Crops

1. *Potato survey.*— The Department of Farm Crops has undertaken to make a survey of the potato industry in New York State. Records will be obtained in the principal potato-growing regions of the State from growers who plant more than ten acres of land with potatoes. These data will be compiled in such a manner as to show the actual practices of potato-growers.

The survey will also develop the practical problems of growers. In the summer of 1913, three hundred and thirty-five records were taken on Long Island and about an equal number in Steuben county.

Farm Management

1. *Questions of business management.*— The greater part of the extension work of the Department of Farm Management is done through correspondence. Questions on all phases of farm management are received and advice is given whenever possible. Information blanks have been prepared for farmers to fill out, from which results for the year can be calculated and frequently suggestions can be made for improvement of the business. As often as possible personal visits are made to farms when such visits are requested.

Floriculture

1. *Greenhouse survey.*— The Department of Floriculture has begun a greenhouse survey of the State.

Forestry

1. *Advice on timberlands.*— The Department of Forestry is prepared to assist owners of New York State timberlands in putting such lands into the most productive condition. On request a member of the staff will visit a tract of land and, while on the ground, will make suggestions for thinning, for the proper harvesting of ripe timber, for protection from fire and from other enemies, and for other measures that will improve the forest. This offer applies equally to the small farm woodlot and to the large timber tract. Advice will also be given on the ground as to the best method of reforesting open lands, kinds of trees to be planted, and methods of planting.

2. *Cooperation in forest development.*— A recent New York State law makes it possible for counties, towns, and villages to acquire and manage forest lands on a permanent basis. This law should have effective results in most sections of the State where there is forest land needing permanent care. The department is ready to aid the citizens of any community in bringing about the establishment of a county, town, or village forest.

The department is prepared to cooperate in matters of forest planting and the care of woodlands with water companies, city water boards, lumber companies, railroads, and other organizations or individuals interested in the permanent development of forest properties.

Home Economics

1. *Home-makers' conference.*— A home-makers' conference is held during Farmers' Week. Series of lectures on various subjects connected with home economics are given during this week, and women from all parts of the State meet to hear the lectures, discuss problems with members of the staff, and exchange notes with other housekeepers of the State.

2. *Reading-Course for the Farm Home.* See page 2405.

Landscape Art

1. *Improvement of rural communities.*— During the past year this department has determined, and in part executed, the arrangement of the grounds about several state institutions, in cooperation with the Fiscal Supervisor of State Charities at Albany. The department is advising a number of rural communities of the State in the matter of town development. Assistance is given also in the arrangement of rural school grounds.

Plant=breeding

1. *Improved varieties of seed.*— The main extension enterprises of this department consist in the arranging of cooperative and demonstrative breeding-plats, and in the distribution of improved varieties of seed. At the present time the department is conducting about ninety cooperative experiments with farmers in the State. In addition to this, one hundred and ninety-five samples of new varieties of corn, oats, and timothy have been distributed and the handling of the seed has been supervised.

Plant Pathology

1. *Control of plant diseases.*— In connection with the investigations enumerated above (page 2391), special attention is given to disseminating information on the general subject of each investigation. In many cases demonstrations of methods of controlling diseases are given.

Pomology

1. *Orchard inspection.*— The Department of Pomology makes orchard inspections and recommends management plans. It also conducts demonstrations of orchard operations at community meetings.

Poultry Husbandry

1. *Poultry farm surveys.*— A representative of the Department of Poultry Husbandry visits poultry farms for the purpose of obtaining detailed information regarding the business aspects of poultry farming. For this purpose, and in order to get in touch with the largest possible number of poultrymen in the State, a blank has been prepared, to be filled out and mailed to the department.
2. *Marketing survey.*— A special investigation is being made of the conditions of producing and marketing poultry and poultry products in the city of Ithaca.
3. *Breed-testing.*— Briefly stated, the purposes of the Cornell breed-testing station are: first, to improve the quality of New York State poultry; second, to give impetus to the practice of better methods of housing, feeding, rearing, and general care; third, to obtain information in regard to the variability in productive characters existing between the classes, breeds, varieties, and strains of poultry and of individuals of a given strain or flock;

fourth, to suggest important lines of research that should be undertaken. Printed rules for breed-testing work may be obtained on application to the department.

4. *Cooperative record-keeping.*— Blank forms are available, giving directions for feeding Cornell rations and providing a monthly record for keeping accounts of egg production, cost of food, mortality, and other important matters.

5. *Poultry institute.*— Each year a special program is prepared to meet the needs of persons who visit the College during Farmers' Week.

6. *Poultry Producers Association of Ithaca.*— This is a cooperative marketing enterprise. Its purpose is primarily educational. The commercial feature is the means by which the educational factor is accomplished. Many of the farmers in the vicinity of Ithaca are marketing their poultry products through this association. The returns to the farmers are in most cases considerably greater than when the products were sold by the former methods. An exact system of cost accounting with each patron is kept. By this means, each person pays his *pro rata* share of all items of expense, and receives returns according to the quality of his products. More than one thousand dollars per year is being saved to the farmers in the vicinity of Ithaca, and the consumers are also benefited by receiving better value.

Rural Economy

1. *Cooperation.*— A study of cooperation in New York State.

Rural Engineering

1. *Drainage.*— Assistance is given to farmers, both by correspondence and by personal visits to their farms, in the engineering problems of farm drainage.

Rural School Education

1. *Cooperation with rural schools.*— In addition to issuing the Cornell Rural School Leaflet, the Department of Rural School Education cooperates with district superintendents and teachers in arranging agricultural contests, demonstrations, and school exhibits, in organizing clubs, and in the working-out of other school problems. During the year 1913–1914 there will be six demonstration rural schools in Tompkins county, two in each supervisory district, in which the department will cooperate with the superintendents in demonstrating what improvements can be made in a rural school in one year.

Soil Technology

1. *Soil surveys.*— Soil surveys are made in order to classify, map, and describe the soil and related agricultural conditions of the State. The unit in this work is the county. The results are published in the form of maps and descriptive reports. One or two counties are surveyed each year.

2. *Chemical composition of soil.*— Following the soil surveys a study is being made of chemical composition, as related to crop production, on the important types of soil.

3. *Drainage problems.*— Problems in land drainage are handled so far as limited facilities will permit. Affiliated with the department is the New York State Drainage Association, which holds annual meetings for the discussion of questions of drainage practice.

4. *Irrigation.*— Irrigation as applied to particular soils and crops is receiving attention. Data are being accumulated concerning the conditions under which irrigation is practicable in New York.

5. *Soil improvement.*— The best method to improve the productive capacity of important types of soil is being studied by means of carefully conducted, long-time series of plats receiving different kinds of fertilizer, lime, rotation, and manurial treatments.

Vegetable-gardening

1. One member of the staff gives his entire time to extension work. Through lectures, winter schools, fair exhibits, and visits to farms, the department offers its services to growers of the State. A series of Reading-Course lessons on home gardening is being issued. These are available on application to the Mailing Division of the College.

PUBLICATIONS OF THE COLLEGE

EXPERIMENT STATION BULLETINS

The experimenting staff is endeavoring to solve some of the more pressing agricultural problems of the State. The results of this work are published in bulletins that are sent free to residents of New York State. A list of available bulletins will be sent on request. Persons who desire to have their names placed on the regular mailing list of the College should address Mailing Division, College of Agriculture, designating one or more of the following subjects in which they are particularly interested: apples, commercial floriculture, general farming, grapes, small tree and bush fruits, commercial vegetable culture, poultry, farm home.

MEMOIRS

The more technical experiment-station bulletins that carry much detailed experimental data and are of interest primarily to persons who are themselves engaged in research, are published in small editions in a special series of Memoirs. These publications are not of interest to the general reader, but will be found of value to advanced students and investigators.

CORNELL READING-COURSES

In order to assist persons who desire to learn but are unable to leave their work, the Cornell Reading-Courses are offered free to residents of New York State. They are not correspondence courses in the usual sense, but are a means of interesting readers in elementary agricultural and household subjects and important rural problems. They aim to stimulate the reading of reliable agricultural literature, and readers are encouraged to express their opinions on the different subjects and to discuss their own experiences. The courses are conducted by means of lessons dealing with practical problems. New lessons are published each month, thus making it possible to present some of the latest available information. The lessons are grouped in series, each series taking up a distinct farm or household enterprise. Lessons in any series are sent one at a time so that the reader may give them careful attention and may receive consecutive information. When the reader has received all the available lessons in any series he is supplied with references for advanced reading, if such references are desired.

A supplement, called a discussion paper, is sent with each Reading-Course lesson. The discussion paper contains questions that aid in reviewing important points in the lesson. Each discussion paper filled out and returned is read carefully and answer is made when it is desired.

Reading-Course for the Farm.—Persons interested in this course are invited to register for one or more of the following series of lessons: the soil, poultry, rural engineering, farm forestry, the horse, dairying, fruit-growing, farm crops, stock-feeding, vegetable-gardening, plant-breeding. The first lesson in a series is sent on enrollment. Succeeding lessons are sent on the return of discussion papers. Address Cornell Reading-Course for the Farm, College of Agriculture.

Reading-Course for the Farm Home.—Similarly there is conducted a Reading-Course for the Farm Home. The lessons are on sanitation, foods, household management, and household furnishing. The course is free to residents of New York State. Address Department of Home Economics, College of Agriculture.

Study clubs.—The Reading-Courses endeavor also to assist in the establishment of clubs throughout the State for the study of the lessons. Granges, farmers' clubs, churches, and other organizations are supplied with Reading-Course lessons on request, and suggestions are made for the preparation of club programs.

ANNOUNCER

This is a monthly publication discussing the kinds of work that are in progress at the College. It announces investigations, extension enterprises on farms and with the people, forthcoming bulletins, reading-courses, local schools, and other events and programs. Any resident of the State may be placed on the mailing list to receive the Announcer on request, so far as the size of the editions will allow. Address Mailing Division, College of Agriculture.

CORNELL RURAL SCHOOL LEAFLET

This publication carries to teachers and school children of the State, subject matter on the topics in nature study and agriculture as outlined by the State Syllabus, together with suggestions and helps for the improvement of rural school conditions. The Cornell Rural School Leaflet for September is sent to all elementary teachers in New York State, and special helps in country-life studies will be sent to boys and girls in communities under rural supervision if requested by the teacher. Address Cornell Rural School Leaflet, College of Agriculture.

MAILING DIVISION

The Mailing Division, as the name implies, is the central mailing agency for the distribution of all official publications of the College. The College is now publishing semi-monthly lessons in the Reading-Courses, a Rural School Leaflet, twenty or more experiment station bulletins and circulars each year, and a monthly publication known as the Announcer of the College of Agriculture. Aside from old publications and annual reports, the Mailing Division is called upon to handle 50,000 copies of publications on the average per week. A part of these are distributed to regular mailing lists and to students, and the remainder are held for supplying the large and constant demand for publications. Following is a tabular statement showing the extent of the mailing lists for the regular publications of the College:

Experiment Station bulletins and circulars	32,500
Reading-Course Lessons for the Farm Home	25,250
Reading-Course Lessons for the Farm	5,000
Announcer	60,000
Rural School Leaflets	175,000
Total	297,750

The distribution of publications requires an up-to-date equipment of mailing machinery and the services of twelve persons. The permanent mailing lists are cut on fiber stencils by means of a machine operating at the rate of fifty stencils per hour. In addressing a list the stencils are passed through a machine capable of printing seventy-five addresses per minute. A special selecting device operates on the addressing machine, which automatically selects according to any classification desired.

In order to eliminate the waste that occurs in placing bulletins in the hands of persons who are not interested in the particular subject-matter contained therein, the mailing list for experiment station publications has been classified under the following eight subjects: apples, commercial floriculture, small tree and bush fruits, grapes, general farming, commercial vegetable culture, poultry, farm home. A classification of the mailing list for Reading-Course

Lessons for the Farm has been arranged under the following subjects: the soil, poultry, rural engineering, farm forestry, the horse, dairying, fruit-growing, farm crops, stock-feeding, vegetable-gardening, plant-breeding.

The Mailing Division has an equipment of multigraph machines for the preparation of circular letters, press notices, and the like. The Supervisor of the Mailing Division supplies special press notices for the papers of the State, giving timely information relating to the care of crops, animals, trees, reports of meetings, notices of extension enterprises, and other matters of general interest.

COURSES OF INSTRUCTION AT THE COLLEGE

The resident courses of instruction offered by the State College of Agriculture are as follows:

REGULAR, OR FOUR-YEARS, COURSE

This course is of equal academic rank with other courses in Cornell University, and leads to the degree of Bachelor of Science. High-school training or its equivalent is necessary for admission. Thorough instruction is offered in the field of agriculture, including courses in agricultural chemistry, animal husbandry, botany and plant physiology, dairy industry, drawing, entomology, biology, nature study, extension teaching, the farm, farm crops, farm management, farm practice, forestry, home economics, floriculture, landscape art, meteorology, plant-breeding, plant pathology, pomology, poultry husbandry, rural economy, soil technology, and vegetable-gardening.

At present the college year in Cornell University is divided into two terms, or semesters, extending from the last of September to the early part of June. In the College of Agriculture there is now being established, in addition, a full third term, to continue from early June until late September. This will enable the college to operate throughout the twelve months of the year; and the summer term will provide special opportunity for advanced students who are otherwise engaged during the regular school year, to have the advantage of a long period of special instruction.

COURSE IN LANDSCAPE ART

The Landscape Art course, requiring special work during the sophomore, junior, and senior years in the four-years course, provides instruction in landscape design and related subjects. At the end of the fifth year the course leads to the degree of Master in Landscape Design.

COURSE IN HOME ECONOMICS

The purpose of the course in Home Economics is to make it possible for women to obtain scientific instruction in subjects which relate to the welfare of the home and which are grouped under the name " home economics."

These subjects include food preparation and preservation, problems of human nutrition, care and feeding of children, household sanitation and management, home care of the sick, sewing, dressmaking, and costume-designing. The special work in subjects dealing with home economics is given during the junior and senior years.

COURSE IN FORESTRY

The course in Forestry, requiring special work during the junior and senior years in the four-years course, provides professional instruction. At the end of a fifth year the course leads to the degree of Master in Forestry.

SPECIAL WORK

Opportunity to pursue special work is provided for those who wish to fit themselves for practical farming but who cannot take a four-years course, and for those who desire to spend one or two years in special study. In order to be eligible for admission to special work, applicants must offer two years of recent farm experience; in addition, they must offer fifteen units of entrance credits or be at least twenty-one years of age. Each application is considered on its merits.

THE WINTER COURSES

The Winter Courses are seven in number: (1) Agriculture, (2) Dairy Industry, (3) Poultry Husbandry, (4) Fruit-growing, (5) Home Economics, (6) Flower-growing, (7) Vegetable-gardening. All courses begin about the middle of November and continue for twelve weeks. These are short, practical courses, open to persons eighteen years of age, or older, who have had at least a common-school education.

A SPECIAL ONE-WEEK COURSE FOR FACTORY AND CREAMERY MANAGERS

This course is intended for managers of creameries and factories who cannot be absent from their business for any considerable time but who wish to come to the College in order to obtain the latest information in their special line of work. At least one year of experience as manager of a factory or a creamery is required for admission.

A TEN-DAYS COURSE IN FANCY CHEESES AND ICE CREAM

This is a special course given after the close of the Winter Course in Dairy Industry. Instruction is provided covering several varieties of fancy cheeses, including cottage, cream, neufchatel, and club, and several kinds of ice cream.

THE SUMMER SCHOOL

A special six-weeks course, covering practically the entire field of agriculture in scope, for principals, teachers, and supervisors of agriculture and home economics. The courses are open also to other qualified persons.

SCHOOL FOR LEADERSHIP IN COUNTRY LIFE

A two-weeks training school for rural social and religious workers, including courses in leadership, rural ethics, rural sociology, rural economics, the farm home and the family, rural surveys, extension teaching in agriculture, rural health and sanitation, rural play and athletics, and the like.

Detailed announcements of any of the foregoing courses may be obtained on application to the Secretary, College of Agriculture, Ithaca, New York.

STATISTICS

ENROLLMENT OF REGULAR, SPECIAL, AND GRADUATE STUDENTS IN CORNELL UNIVERSITY

As reported for the first term of each year

	1913	1912	1911
Agriculture	1,354	1,185	894
Arts	1,120	1,051	954
Mechanical Engineering	874	933	1,014
Civil Engineering	469	486	542
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ENROLLMENT OF STUDENTS IN AGRICULTURE

1868-1869 to 1912-1913

1868–1869		
Regulars		30
1869–1870		
Regulars		24
1870–1871		
Regulars		20
1871–1872		
Regulars		13
1872–1873		
Regulars		15
1873–1874		
Regulars		7
1874–1875		
Regulars	17	
Specials	1	
		18
1875–1876		
Regulars	9	
Specials	2	
		11
1876–1877		
Regulars	28	
Specials	1	
		29

1877–1878		
Regulars	37	
Specials	5	
Graduates	1	
		43
1878–1879		
Regulars	34	
Specials	7	
		41
1879–1880		
Regulars	33	
Specials	2	
		35
1880–1881		
Regulars		26
1881–1882		
Regulars	16	
Specials	1	
Graduates	1	
		18
1882–1883		
Regulars		15
1883–1884		
Regulars		13
1884–1885		
Regulars	18	
Specials	2	
		20
1885–1886		
Regulars		23
1886–1887		
Regulars	33	
Specials	5	
		38
1887–1888		
Regulars	33	
Specials	12	
		45

1888–1889		
Regulars	37	
Specials	21	
Graduates	2	
		60
1889–1890		
Regulars	28	
Specials	21	
Graduates	3	
		52
1890–1891		
Regulars	32	
Specials	20	
Graduates	6	
		58
1891–1892		
Regulars	22	
Specials	19	
Graduates	12	
		53
1892–1893		
Regulars	24	
Specials	24	
Graduates	9	
Winter courses	48	
		105
1893–1894		
Regulars	25	
Specials	20	
Graduates	9	
Winter courses	61	
		115
1894–1895		
Regulars	24	
Specials	21	
Graduates	9	
Winter courses	77	
		131
1895–1896		
Regulars	30	
Specials	21	
Graduates	13	
Winter courses	83	
		147

1896–1897		
Regulars	34	
Specials	34	
Graduates	22	
Winter courses	60	
		150
1897–1898		
Regulars	56	
Specials	28	
Graduates	20	
Winter courses	93	
		197
1898–1899		
Regulars	46	
Specials	39	
Graduates	17	
Winter courses	89	
		191
1899–1900		
Regulars	43	
Specials	45	
Graduates	19	
Winter courses	83	
		190
1900–1901		
Regulars	48	
Specials	50	
Graduates	23	
Winter courses	94	
		215
1901–1902		
Regulars	49	
Specials	43	
Graduates	22	
Winter courses	96	
		210
1902–1903		
Regulars	60	
Specials	53	
Graduates	18	
Winter courses	121	
		252
1903–1904		
Regulars	77	
Specials	64	
Graduates	21	
Winter courses	134	
		296
1904–1905		
Regulars	98	
Specials	90	
Graduates	31	
Winter courses	199	
		418
1905–1906		
Regulars	128	
Specials	102	
Graduates	40	
Winter courses	248	
		518
1906–1907		
Regulars	145	
Specials	133	
Graduates	36	
Winter courses	244	
		558
1907–1908		
Regulars	206	
Specials	142	
Graduates	43	
Winter courses	270	
		661
1908–1909		
Regulars	268	
Specials	145	
Graduates	58	
Winter courses	364	
		835
1909–1910		
Regulars	419	
Specials	120	
Graduates	57	
Winter courses	371	
		967

1910–1911		
Regulars	597	
Specials	169	
Graduates	80	
Winter courses	477	
Summer school	128	
		1,451
1911–1912		
Regulars	806	
Specials	180	
Graduates	119	
1911–1912 (*continued*)		
Winter courses	451	
Summer school	223	
		1,779
1912–1913		
Regulars	1,103	
Specials	161	
Graduates	111	
Winter courses	597	
Summer school	333	
		2,305

DETAILED ENROLLMENT IN AGRICULTURE

First term, 1913-1914

Freshmen		401
Sophomores		341
Juniors		294
Seniors		205
Specials		115
		1,356
Old students	860	
New students	496	
		1,356
Graduate students taking part or all of their work in agriculture		135
Total for first term		1,491
Number of women in regular course 1913–1914		176
Number of women special students 1913–1914		19
Total		195
Number of non-resident students in the College of Agriculture 1st term 1913–1914:		
Old students:		
Regulars	135	
Specials	5	
		140
New students:		
Regulars	122	
Specials	13	
		135
Total		275

Number of students in winter courses, 1913–1914	555
Total enrollment of all grades, first term, 1913–1914	2,046

Percentage increase in total enrollment over same date 1912–1913	14.5
Percentage increase in nonresident students over same date 1912–1913	115.6
Percentage of regular students in total enrollment	91.5
Percentage of special students in total enrollment	8.5

The registration for the second term and for the summer school is not included in the above summary, therefore the figures are not comparable with the total for 1912–1913.

DEGREES CONFERRED ON STUDENTS IN AGRICULTURE

1868–1869 to 1912–1913

Year	Degree	Number receiving degree
1869	Bachelor of Science	.....
1870	Bachelor of Science	.....
1871	Bachelor of Science	.....
1872	Bachelor of Science	.....
1873	Bachelor of Agriculture	2
1874	Bachelor of Agriculture	2
1875	Bachelor of Agriculture	1
1876	Bachelor of Agriculture	1
1877	Bachelor of Agriculture	2
1878	Bachelor of Agriculture	1
1879	Bachelor of Agriculture	.....
1880	Bachelor of Agriculture	3
1881	Bachelor of Agriculture	8
1882	Bachelor of Agriculture	4
1883	Bachelor of Agriculture	2
1884	Bachelor of Agriculture	2
1885	Bachelor of Agriculture	2
1886	Bachelor of Science in Agriculture	1
1887	Bachelor of Science in Agriculture	.....
1888	Bachelor of Science in Agriculture	7
1889	Bachelor of Science in Agriculture	6
1890	Bachelor of Science in Agriculture	7
1891	Bachelor of Science in Agriculture	11
1892	Bachelor of Science in Agriculture	8
1893	Bachelor of Science in Agriculture	3
1894	Bachelor of Science in Agriculture	4
1895	Bachelor of Science in Agriculture	4
1896	Bachelor of Science in Agriculture	5
1897	Bachelor of the Science of Agriculture	8

Year	Degree	Number receiving degree
1898	Bachelor of the Science of Agriculture	9
1899	Bachelor of the Science of Agriculture	12
1900	Bachelor of the Science of Agriculture	8
1901	Bachelor of the Science of Agriculture	14
1902	Bachelor of the Science of Agriculture	8
1903	Bachelor of the Science of Agriculture	8
1904	Bachelor of the Science of Agriculture	14
1905	Bachelor of the Science of Agriculture	19
1906	Bachelor of the Science of Agriculture	27
1907	Bachelor of Science in Agriculture	25
1908	Bachelor of Science in Agriculture	39
1909	Bachelor of Science in Agriculture	42
1910	Bachelor of Science in Agriculture	47
1911	Bachelor of Science in Agriculture	79
1912	Bachelor of Science in Agriculture	41
1912	Bachelor of Science	78
1913	Bachelor of Science in Agriculture	5
1913	Bachelor of Science	160

STUDENTS' ORGANIZATIONS

The students in the College of Agriculture have associated themselves together in a number of organizations representing the several teaching and social activities. The following clubs indicate the nature of such association: Lazy Club (three divisions: Pomology, Floriculture, and Vegetable-gardening), Round-up Club (Animal Husbandry), Synapsis Club (Plant-breeding), Jugatae (Entomology), Plant Doctors, Forestry Club, Poultry Association, Cornell Chapter of American Society of Agronomy (composed of members of the faculty and graduate students), Frigga Fylge (girls' club), Agricultural Musical Clubs (representing the glee club and the mandolin club), and the Board of Athletic Control of the College of Agriculture (representing the track, cross-country, crew, baseball, soccer, football, and basket-ball interests). There are two senior honorary societies in the college, Hebs-sa and Helios.

The students in the winter courses have their special clubs, and each year these students have interclub debates for the Morrison Winter-course Trophy Cup.

All these organizations are represented and united in the Agricultural Association, which is considered to be the oldest association of students in Cornell University, having been organized in 1871. The Agricultural Assembly, which meets on the first Thursday evening of each month during the college year, is the comprehensive association of the interests of the College, when faculty and students meet together on a common social basis. The College has its own student oratorical stage, and its own student periodical, The Cornell Countryman.

Students' Association.— The Students' Association of the New York State College of Agriculture is an organization of all present and former students for the promotion of agriculture and rural betterment. By the organization of local or county branches, it is planned to extend its work through cooperation in the holding of extension schools, cooperative experiments, farm demonstrations, lecture courses, reading-courses, and the like. An annual meeting is held at the College in Farmers' Week. This association has become an important factor in the larger work of the College, and its influence will increase through the organization within it of a Committee of Twenty-five which keeps in touch with the institution in all its activities.

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